UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

ASM AMERICA, INC.,

Plaintiff,

v.

GENUS, INC.,

Defendant.
_______________________________________/

GENUS, INC.,

Counterclaimant,

v.

ASM AMERICA, INC., and
ASM INTERNATIONAL, N.V.,

Counterdefendants.
_______________________________________/

No. C-01-2190 EDL

ORDER RE: CLAIM CONSTRUCTION OF UNITED STATES PATENTS NOS. 6,015,590, 5,916,365, AND 5,294,568

Currently before the Court is the parties' dispute over the proper construction of United States Patents Nos. 6,015,590 ("the '590 patent"), 5,916,365 ("the '365 patent"), and 5,294,568 ("the '568 patent").

I. Background

Plaintiffs ASM America, Inc. and Arthur Sherman (collectively, "ASM") have filed suit against defendant Genus, Inc. ("Genus") for patent infringement. According to the complaint, ASM invents, manufactures, and sells equipment for use in making integrated circuits. ASM's products include atomic layer chemical vapor deposition ("ALCVD") machines, which are used to form exceptionally thin layers of insulating material, conducting material, and semi-conducting material using a technique generally known as Atomic Layer Deposition ("ALD") or Atomic Layer Epitaxy ("ALE"). Genus allegedly manufactures, offers for sale, and sells ALD process and equipment in competition with ASM's ALCVD process and equipment.

ASM contends that Genus is infringing three patents: the '590 and '365 patents, and United States Patent No. 4,798,165 ("the '165 patent"). ASM alleges that it owns the '590 and '165 patents, and has enforceable rights in the '365 patent. Plaintiff Arthur Sherman is alleged to be the inventor and owner of the '365 patent. ASM alleges that Genus is infringing claims 1 through 10 of the '590 patent, claims 1, 2, 3, 4, 5, 6, 9, 11, 12, 16, and 17 of the '365 patent, and claims 1, 5, 6, 7, 9, 10, and 11 of the '165 patent. Genus has counterclaimed and alleges, among other things, that ASM is infringing claims 1 and 8 of United States Patent No. 5,294,568 ("the '568 patent").

The Court held a claim construction hearing for the '590 and '365 patents on June 17, 2002, and then permitted the parties to file supplemental briefing. The claim construction hearing for the '568 patent was held on June 24, 2002. The claim construction hearing for the '165 patent is scheduled for September 26, 2002 at 9:00 a.m.

II. DISCUSSION

The construction of a patent claim is a matter of law for the Court. Markman v. Westview Instruments, Inc., 517 U.S. 370, 372 (1996). As the claim language defines the scope of the claim, the claim construction analysis always begins with the words of the claim. Teleflex, Inc. v. Ficosa North America Corp., 2002 WL 1358720 at *6 (Fed. Cir. June 20, 2002). The words used in the claim are interpreted in light of the intrinsic evidence, i.e., the rest of the specification and, if in evidence, the prosecution history. Id. at *7; CCS Fitness, Inc. v. Brunswick Corp., 288 F.3d 1359, 1366 (Fed. Cir. 2002). The intrinsic evidence is the most significant source of the legally operative meaning of disputed claim language. Teleflex at *7 (quoting Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir. 1996)). Courts may also use extrinsic evidence (e.g., expert testimony, treatises) to resolve the scope and meaning of a claim. CCS Fitness, 288 F.3d at 1366.

There is a heavy presumption that a claim term carries its ordinary and customary meaning. Teleflex at *7 (citing CCS Fitness, 288 F.3d at 1366). "The subjective intent of the inventor when he used a particular term is of little or no probative weight in determining the scope of a claim (except as documented in the prosecution history)." Markman v. Westview Instruments, Inc., 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc), aff'd, Markman, 517 U.S. 370; Markman, 50 F.3d at 985 (citation omitted). "Rather the focus is on the objective test of what one of ordinary skill in the art at the time of the invention would have understood the term to mean." Id. at 986. Dictionary definitions may establish a claim term's ordinary meaning, as long as the dictionary definition does not contradict any definition found in or ascertained by a reading of the patent documents. CCS Fitness, 288 F.3d at 1366. "A technical term used in a patent document is interpreted as having the meaning that it would be given by persons experienced in the field of the invention, unless it is apparent from the patent and the prosecution history that the inventor used the term with a different meaning." Hoechst Celanese Corp. v. BP Chems. Ltd., 78 F.3d 1575, 1578 (Fed. Cir. 1996).

An accused infringer may overcome the heavy presumption that a claim term carries its ordinary and customary meaning, but he cannot do so simply by pointing to the preferred embodiment or other structures or steps disclosed in the specification or prosecution history. CCS Fitness, 288 F.3d at 1366. Neither the specification nor the title of the patent can be used to import limitations into the claims that are not found in the claims themselves. Pitney-Bowes, 182 F.3d at 1312. While the claims must be read in view of the specification, limitations from the specification are not to be read into the claims. Teleflex at *8.

The ordinary meaning of a claim term may be overcome in at least four ways. CCS Fitness, 288 F.3d at 1366. First, the claim term will not receive its ordinary meaning if the patentee acted as his own lexicographer and clearly set forth a definition of the disputed claim term in either the specification or prosecution history. Id.

Second, a claim term will not carry its ordinary meaning if the intrinsic evidence shows that the patentee distinguished that term from prior art on the basis of a particular embodiment, expressly disclaimed subject matter, or described a particular embodiment as important to the invention. Id. at 1366-67. The prosecution history limits the interpretation of claims so as to exclude any interpretation that may have been disclaimed or disavowed during prosecution in order to obtain claim allowance. Teleflex at *8 (quoting Standard Oil Co. v. Am. Cyanamid Co., 774 F.2d 448, 452 (Fed. Cir. 1985)).

> In contrast, when claim changes or arguments are made in order to more particularly point out the applicant's invention, the purpose is to impart precision, not to overcome prior art. Such prosecution is not presumed to raise an estoppel, but is reviewed on its facts, with the guidance of precedent.

Pall Corp. v. Micron Separations, Inc ., 66 F.3d 1211, 1220 (Fed. Cir. 1995) (citations omitted).

Third, a claim term also will not have its ordinary meaning if the term chosen by the patentee so deprives the claim of clarity as to require resort to the other intrinsic evidence for a definite meaning. CCS Fitness, 288 F.3d at 1367. Finally, as a matter of statutory authority, a claim term will cover nothing more than the corresponding structure or step disclosed in the specification, as well as equivalents thereto, if the patentee phrased the claim in step- or means-plus-function format. Id. (citing 35 U.S.C. § 112 ¶ 6.)

A. The'590 patent

The '590 patent is entitled "Method for Growing Thin Films." All of the disputed terms appear in claim 1, which claims:

> A method for growing a thin film onto a substrate, in which a substrate is placed in a reaction space and said substrate is subjected to alternately repeated surface reactions of a plurality of vapor phase reactants to form a thin film, said method comprising the steps of:
>
> feeding said vapor phase reactants into said reaction space in the form of vapor phase pulses repeatedly and alternately, each reactant separately from its own source;
>
> causing said vapor phase reactants to react with the surface of the substrate to form a thin film compound on said substrate;
>
> evacuating said reaction space between two successive vapor phase pulses by connecting the reaction space to a pump so that substantially all of said reactants remaining in said reaction space and adsorbed on inner walls of said reaction space are removed to a level of less than 1% prior to the inflow of a second pulse of said two successive vapor phase pulses; and
>
> feeding an inactive gas into said reaction space simultaneously with said evacuating step.

('590 patent 11:41-12:4.)

ASM asks the Court to construe the following terms from the claims of the '590 patent.

/ /

Disputed Claim Language	ASM's construction	Genus's construction
Evacuate	The removal of reactant residues in the vapor phase with the assistance of a pump that is connected to the reaction space.	Reducing the pressure in the reaction space with a vacuum pump to remove gas from the reaction space.

The dispute here is whether evacuation requires the use of a vacuum to suck the reactants out of the reaction space (which the parties often refer to as "pump-down"), or whether it encompasses removal of the reactants by any means, including using another gas to push the reactants out of the reaction space (which the parties sometimes refer to as "purging"). Genus argues for the former construction, while ASM argues for the latter. ASM concedes, in its response to Genus' supplemental claim construction brief, that one common usage of "evacuation" is to describe a pump-down. ASM argues that "evacuation" is also commonly used as a generic term for removal, however, and that this latter definition applies in the context of the '590 patent.

The specification of the '590 patent expressly defines "evacuation."

> In the context of the present invention, the term "evacuation" is used generally referring to the removal of reactant residues in the vapor phase. The evacuation of the reaction space can be accomplished by purging the gas volume of the apparatus by means of at least one pumping cycle capable of lowering the internal pressure in the apparatus to a sufficiently high vacuum. When required, the apparatus may be simultaneously filled with an inactive gas which promotes the purging of the reactant residues from the reaction space.

('590 patent 3:64-4:5.)[1] This definition is somewhat ambiguous. On the one hand, it clearly states that "evacuation" is used generally to refer to removal of reactant gases. The second sentence makes it clear that evacuation can be accomplished by a pump-down. On the other hand, the next sentence does not make it clear whether the use of an inactive gas to purge the reactant gases from the reaction space is part of the evacuation step, or whether it is a separate event that takes place simultaneously with evacuation.

The language of claim 1 suggests that evacuation is separate from the use of an inert gas to purge the reactant gases from the reaction space. Claim 1 provides:

> <u>evacuating said reaction space between two successive vapor phase pulses by connecting the reaction space to a pump</u> so that substantially all of said reactants remaining in said reaction space and adsorbed on inner walls of said reaction space are removed to a level of less than 1% prior to the inflow of a second pulse of said two successive vapor phase pulses; <u>and</u>
>
> <u>feeding an inactive gas into said reaction space simultaneously with said evacuating step.</u>

('590 patent, 11:53-12:4 (emphasis added).) Although claim 1 does not specifically state that the pump must <u>suck</u> the gas out of the reaction space (as opposed to a bellows-like pump that <u>pushes</u> the gas out), the specification makes it clear that only a vacuum-type pump is used. "The invention can be implemented using any suitable pump capable of establishing a sufficient vacuum in the reaction space and having a sufficient capacity." ('590 patent, 5:44-46.) The parties do not argue otherwise. As the claim language states that feeding the inactive gas into the reaction space occurs simultaneously with the evacuation step, it suggests that using the inactive gas is not part of the evacuation step.

---

[1] Although the parties often refer to the use of an inert gas to push the reactant gas out of the reaction chamber as "purging," this definition also uses "purging" to describe a pump-down.

Other language in the patent also distinguishes the evacuation step from the step of introducing an inactive gas to push out the reactant gases. At one point, the specification refers to "[t]he evacuating steps and possible complementing step of flushing with an inactive gas." ('590 patent 8:12-13.) The claims, of course, require both steps, but this language also supports Genus' contention that evacuation does not encompass the use of an inert gas to push the reactant gases out of the reaction space. The specification also provides that "an inactive gas may advantageously be introduced to the reaction space during the evacuation." ('590 patent 11:37-39.) This language is a little more ambiguous, but adding the inactive gas during the evacuation does not necessarily mean that the addition of the inactive gas is considered to be part of the evacuation, particularly in light of the other language cited above.

There is also language, however, that can be read to equate evacuation with the use of the inert gas.

> Advantageously, the interval between the successive pulses is kept so long as to permit the evacuation of the reaction space using at least a double or triple purging gas volume during the interval between the pulses. To achieve maximally efficient evacuation of reactant residues, the reaction space is purged with an inactive gas during the interval between the reactant pulses and the total volume of gas evacuated from the reaction space during the interval between the reactant pulses amounts to at least 2-10 times the volume of the reaction space.

('590 patent 5:15-22.) This language arguably supports ASM's argument that "evacuation" simply means removal, and includes using an inert gas. It also can be read, however, to mean only that evacuation is enhanced by the simultaneous use of the inactive gas. In other words, although evacuation is the process of sucking the reactant gases out of the reaction space, that process works more efficiently when the reactant gases are also pushed out from the other side by adding an inert gas into the reaction space.

ASM also argues that the specification states that the apparatus of United States Patent No. 4,389,973 (the '973 patent) is suited to implement the invention. ASM contends that the '973 patent uses a traveling wave reactor in which the reactants are separated by a diffusion barrier of inert gas. If the '973 apparatus is suited to practicing the invention of the '590 patent, then, according to ASM, this shows that "evacuation" in the context of the '590 patent must be broad enough to include the use of an inert gas to clear the reaction space of reactant gases, because that is the only process the '973 patent uses. ASM's argument fails, however, because the '590 patent does not state that the '973 apparatus is suitable for practicing the invention of the '590 patent. Rather, the '590 patent states: "The ALE method is described in the FI patent publications 52,369 and 57,965 and in the U.S. Pat. Nos. 4,058,430 and 4,389,973, in which also some apparatus suited to implement this method are disclosed." ('590 patent 2:15-18.) In context, the reference to "this method" refers back to the "ALE method," and does not refer to the invention of the '590 patent. Thus, this language of the '590 patent simply makes the innocuous assertion that the '973 patent discloses an apparatus for performing ALE, which no one disputes.

Genus points out that the prosecution history distinguishes between evacuation and using an inert gas to push the reactant gases out of the reaction chamber. The patent examiner rejected certain claims as anticipated by, and obvious in light of, U.S. Patent No. 4,975,252 ("the Nishizawa patent"). (Gasner '590 Decl., Ex. 6 (Prosecution History) at 149). The patent examiner took the position that the Nishizawa patent taught the use of an ultrahigh vacuum to remove the reactant gases from the reaction space. Id. The inventors of the '590 patent responded that their invention was different because it used both a vacuum pump and the feeding of an inert gas into the chamber to evacuate the reaction space. Id. at 165. The inventors stated that:

> Nishizawa teaches discharging the reactor by *evacuating* it to an *ultrahigh vacuum*. This necessarily indicates that a very low pressure must be maintained in the reaction chamber between successive pulses.
>
> In contrast, by using the inactive gas and the evacuation technique taught by the claimed invention, the reactor space is discharged at pressure that is decades above the pressure required by the Nishizawa reference. Thus, the solution taught by the claimed invention can be implemented using pumps that are both smaller and more economical than the pumps employed with conventional methods.
>
> This feature is disclosed in the specification. For example on page 8, lines 24-27, it is stated: "The invention can be implemented using any suitable pump capable of establishing a *sufficient* vacuum in the reaction space having a sufficient capacity. . . ." The *ultrahigh vacuum* required by Nishizawa is more difficult to achieve than the *sufficient* vacuum as described in the patent specification. Thus, Nishizawa does not teach nor suggest that a reaction space can be evacuated without using an ultrahigh vacuum.
>
> In addition, Nishizawa does not teach nor suggest the use of an inactive or inert gas to be fed into the reactor space between successive pulses. Nishizawa only describes discharging the reactor by evacuating it to an ultrahigh vacuum. In contrast, the claimed invention teaches that by feeding gas into the reactor space between pulses, the inert gas pushes out the previous pulse from the reactor apparatus. Therefore, in contrast to the Nishizawa, an *ultrahigh* vacuum (i.e., ultra low pressure in the reaction chamber) between pulses is not required by the claimed invention.

Id. By referring to "the inactive gas and the evacuation technique taught by the claimed invention," the inventors appear to exclude the use of the inert gas from the definition of "evacuation." This language also supports Genus' contention that "evacuation" is limited to the use of a vacuum, i.e., a pump-down, and does not encompass purging the reaction chamber with an inert gas.

The fact that a vacuum pump is used does not require, as Genus contends, that there must be a pressure drop in the reaction space during evacuation, however, in the context of the invention of the '590 patent. Evacuation of the reaction space occurs simultaneously with the feeding of an inactive gas into the reaction space. Claim 1 and the specification make it clear that the gases in the reaction space are both pumped out and pushed out simultaneously. If the vacuum pump is stronger than the input feed for the inactive gas, then there will be a pressure drop. If the inactive gas is being fed into the reaction space at the same volume and rate or faster than the vacuum pump is sucking the gases out, however, then the gases will still be removed from the reaction space, but there will be no pressure drop. The inventors' statements to the patent examiner about using a "sufficient vacuum" only distinguished the ultrahigh vacuum, as used in the Nishizawa patent, from the invention of the '590 patent, which can evacuate the reaction space without using an ultrahigh vacuum.

It is true, as a matter of law, that "the prosecution history (or file wrapper) limits the interpretation of claims so as to exclude any interpretation that may have been disclaimed or disavowed during prosecution in order to obtain claim allowance." Pall Corp. v. PTI Technologies, Inc., 259 F.3d 1383, 1393 (Fed. Cir. 2001) (quoting Standard Oil., 774 F.2d at 452-53). "The public notice function of patents requires that a patentee be prevented from expressly stating during prosecution that the claims do not cover a particular device and then later suing for infringement by that same device." Id. Here, however, the inventors only disclaimed an evacuation process that uses an ultrahigh vacuum. They did not disclaim any other evacuation process. In other words, by stating that their process worked without an ultrahigh vacuum in the reaction space, they did not disclaim a process that removed gases from the reaction space with a lesser vacuum or a process in which there is no pressure drop during removal of the reactants. As the invention of the '590 patent uses a vacuum pump at the outlet of the reaction space to remove reactant gases, coupled with a simultaneous inflow of an inert gas at the inlet of the reaction space, the pressure in the reaction space depends on the comparative partial pressures of the incoming and outgoing gases, as explained above, which may or may not create a pressure drop in the reaction space.

It is undisputed that all ALD processes operate in a vacuum. (See, e.g., Glew Expert Report at 4; Glew Rebuttal Expert Report at 3.)[2] In all ALD processes, the vacuum pump is always operating so that the

---

[2] The parties stipulated that their expert reports would substitute for the direct testimony of their expert witnesses at the claim construction hearings.

reaction chamber is always at a lower pressure than the outside atmosphere. (Glew Expert Report at 4.) Thus, it appears that every flow system includes both a purging gas and a vacuum pump. In order to distinguish flow systems from the system of the ’590 patent, it is necessary to distinguish the vacuum used to suck the gases out of the reaction chamber from the ordinary vacuum that is always present in the reaction chamber. The relevant claim languages requires “evacuating said reaction space between two successive vapor phase pulses by connecting the reaction space to a pump[.]” (’590 patent 11:53-55.) It appears to the Court that, in the ’590 process, the vacuum pump must increase its suction between vapor phase pulses in order to evacuate the reaction space, that is, the vacuum pump operates at different rates at different times in the process. This does not necessarily create a pressure drop, however, because an inactive gas is simultaneously being fed into the chamber to purge the chamber of reactants. If the increase in suction is met by an identical increase in the flow of the inactive gas, there will be no pressure change in the reaction chamber, yet the chamber will still be emptied of reactant gases.

Genus also point to the use of “evacuate” in some of the patents cited in the ’590 patent, each of which uses “evacuate” to describe a pump-down. See Brown Decl., Ex. I, United States Patent No. 4,058,430 at 5:67-6:2 (“the reaction chamber being evacuated between consecutive steps by action of a vacuum pump (not shown) which draws the gas out”); Ex. J, United States Patent No. 4,975,252 at 3:33-34 (“evacuating means for evacuating the crystal growth vessel to a [sic] ultrahigh vacuum”); Ex. K, United States Patent No. 4,933,357 at 3:55-58 (“instead of supplying a flushing gas, the chamber may also be evacuated between the supplying of the compound of the element or elements”). The Federal Circuit has held that “[p]rior art cited in the prosecution history falls within the category of intrinsic evidence.” Tate Access Floors, Inc. v. Interface Architectural Resources, Inc., 279 F.3d 1357, 1371 n.4 (Fed. Cir. 2002). This intrinsic evidence also supports Genus’ position.

Accordingly, the Court concludes from the intrinsic evidence that “evacuation” means removal by a vacuum pump, and does not include the use of inert gas to push the reactant gases out of the reaction space.

The parties also point to extrinsic evidence of the meaning of “evacuation.” Federal Circuit law on the consideration of extrinsic evidence during claim construction is in flux, but the trend is that consideration of reliable extrinsic evidence is appropriate, and sometimes necessary. In 1996, the Federal Circuit held, in Vitronics, that “[i]n those cases where the public record unambiguously describes the scope of the patented invention, reliance on any extrinsic evidence is improper.” Vitronics, 90 F.3d at 1583. “The claims, specification, and file history, rather than extrinsic evidence, constitute the public record of the patentee's claim, a record on which the public is entitled to rely." Id. "Allowing the public record to be altered or changed by extrinsic evidence introduced at trial, such as expert testimony, would make this right meaningless." Id.

The Court later clarified, however, that "Vitronics does not prohibit courts from examining extrinsic evidence, even when the patent document is itself clear." Pitney-Bowes, 182 F.3d at 1308. "Rather, Vitronics merely warned courts not to rely on extrinsic evidence in claim construction to contradict the meaning of claims discernible from thoughtful examination of the claims, the written description, and the prosecution history – the intrinsic evidence." Id. (emphasis in original).

> Thus, under Vitronics, it is entirely appropriate, perhaps even preferable, for a court to consult trustworthy extrinsic evidence to ensure that the claim construction it is tending to from the patent file is not inconsistent with clearly expressed, plainly apposite, and widely held understandings in the pertinent technical field. This is especially the case with respect to technical terms, as opposed to non-technical terms in general usage or terms of art in the claim-drafting art, such as 'comprising.' Indeed, a patent is both a technical and a legal document. While a judge is well-equipped to interpret the legal aspects of the document, he or she must also interpret the technical aspects of the document, and indeed its overall meaning, from the vantage point of one skilled in the art.

Id. at 1309. A majority of the panel in Pitney-Bowes also noted that:

> The process of claim construction at the trial court level will often benefit from expert testimony which may (1) supply a proper technological context to understand the claims (words often have meaning only in context), (2) explain the meaning of claim terms as understood by one of skill in the art (the ultimate standard for claim meaning), and (3) help the trial court understand the patent process itself (complex prosecution histories – not to mention specifications – are not familiar to most trial courts).

Id. at 1314. Thus, after Pitney-Bowes, it is clear that the Court may consider trustworthy extrinsic evidence, even when the meaning of the disputed terms is clear from a review of the intrinsic evidence. It may not, however, rely on that evidence to contradict the meaning of claim terms that is clear from the intrinsic evidence. Id. at 1308; see also Bell & Howell Document Management Products Co. v. Altek Systems, 132 F.3d 701, 705-07 (Fed. Cir. 1997) (reversing claim construction because the district court relied on expert testimony to construe claim language in a manner that contradicted the clear and unambiguous meaning set forth in the intrinsic evidence).

In AFG Industries, Inc. v. Cardinal IG Co., Inc., 239 F.3d 1239 (Fed. Cir. 2001), the Circuit quoted at length from the deposition testimony of the president of the defendant's company, as a person of ordinary skill in the art, in determining the correct construction of certain claim terms. Id. at 1246. The deposition testimony supported the opposing party's claim construction. The court noted that "[t]his case presents a good example of how extrinsic evidence can and should be used to inform a court's claim construction, and how failure to take into account the testimony of persons of ordinary skill in the art may constitute reversible error." Id. at 1249.

Earlier this year, the Federal Circuit held that "Courts may also use extrinsic evidence (e.g., expert testimony, treatises) to resolve the scope and meaning of a claim term." CCS, 288 F.3d at 1366. There, however, the Federal Circuit found that it did not need to examine expert testimony because the meaning of the term at issue could be determined by resort to the intrinsic evidence and dictionary definitions. Id. at 1368. The Court noted that even if it reviewed the expert testimony presented there,
including that of the inventor himself, the expert testimony was not helpful because it was in conflict.

Id. The Court noted, however, that the inventor was presumably a person of ordinary skill in the art, and thus suggested that consideration of the inventor's testimony would be proper. Id. This is consistent with the Federal Circuit's earlier decision, Voice Technologies Group, Inc. v. VMC Systems, Inc., 164 F.3d 605 (Fed. Cir. 1999), in which the court held that "[a]n inventor is a competent witness to explain the invention and what was intended to be conveyed by the specification and covered by the claims." Id. at 615. The inventor cannot, however, "by later testimony change the invention and the claims from their meaning at the time the patent was drafted and granted." Id. at 615. Similarly, the Federal Circuit held in Solomon v. Kimberly-Clark Corp., 216 F.3d 1372 (Fed. Cir. 2000) that inventor testimony should not be used to invalidate a patent for indefiniteness under § 112 ¶ 2 because once the patent issues, the claims and written description must be viewed objectively from the standpoint of a person of skill in the art. Id. at 1379-80. Thus, although inventor testimony, like other extrinsic evidence, may be considered by the Court, it may not be relied upon to contradict the meaning of patent language that is clear from the intrinsic evidence.

Despite this plethora of recent authority holding that the Court may consider trustworthy extrinsic evidence during claim construction, ASM contends that an earlier Federal Circuit decision, Water Technologies Corp. v. Calco, Ltd., 850 F.2d 660 (Fed. Cir. 1988), bars this Court from considering statements made about the patents at issue during the prosecution of later patents. In Water Technologies, the exclusive licensee of two earlier patents argued, during the prosecution of later patents on improvements to those inventions, that the claims of the earlier patents were limited in a certain way. Id. at 667. The Federal

Circuit, in a cursory discussion, held: "We see no reason why arguments made by a later attorney prosecuting later patent applications for a different inventor should be used to limit an earlier-issued patent[.]" Id. (emphasis in original). The Federal Circuit noted that claims must be construed in light of the claim language, the other claims, the prior art, the prosecution history, and the specification. Id. (emphasis in original). The court did not even discuss, however, whether it could also rely on extrinsic evidence of the meaning of the claims by persons of ordinary skill in the art. The post-Markman cases cited above make it clear that the Court may, and sometime must, consider such evidence. To the extent that Water Technologies holds that such statements can never be relevant to claim construction of the earlier patents, it is no longer good law. The law is now clear that the Court may consider trustworthy extrinsic evidence during claim construction, as long as it does not rely on such evidence to construe the claims in a way that contradicts the clear meaning of the claims as determined from a review of the intrinsic evidence.

Genus' expert William Oldham states in his expert report that the term "evacuate," in the semiconductor manufacturing industry, is not normally used to refer to any method of removing gases, but rather is used to refer to the reduction of pressure in an enclosed space to a vacuum. (Oldham Expert Report at 5.) "Specifically, 'evacuate' is used to describe the method in which the materials being moved are being sucked out (as opposed to pushed out or adsorbed onto the walls, for example)." Id. ASM's expert, Alexander D. Glew, does not opine in his expert report on how the term "evacuate" is generally used in the semiconductor manufacturing industry. Instead, he limits his expert opinion to how a person of ordinary skill in the art would interpret the term in the context of the '590 patent. (Glew Expert Report at 7.)

Genus also points to statements made to the Patent Office by patent counsel for ASM's Chief Technology Officer, Ivo Raaijmakers, in connection with a pending patent application. The Patent Office rejected certain claims in that application as obvious in light of the '590 and '365 patents. (Sun '590 Reply Decl. Ex. 2 at 7.) Raaijmakers' counsel filed a Response to Office Action on November 2, 2001, arguing that:

> the present invention does not disclose evacuating the excess gas between sequential introduction of reactants. Rather, the present invention describes keeping carrier gas flowing over the substrate and providing concentration pulses of reactant gases in the carrier gas . . . . There is no evacuation of the chamber between pulses of reactant gases. This is a fundamental difference between the present invention and the references cited [the '590 and '365 patents].

(Id. at 8.)

> Even if Suntola [the ’590 patent] were combined with Sherman [the ’365 patent], the present invention would not be obvious to one of ordinary skill in the art because neither Suntola nor Sherman utilizes a carrier gas that flows through the deposition process. Suntola and Sherman teach away from the present invention because both Suntola and Sherman require evacuation of the chamber between pulses of reactants.

Genus argues that ASM’s argument that the ’590 patent “teaches away” from the use of “a carrier gas flow that flows throughout the deposition process” because the ’590 patent requires “evacuation of the chamber between pulses” is directly inconsistent with ASM’s litigation position here that the term “evacuation” in the ’590 patent is broad enough to encompass any type of removal, including removal assisted by the use of inactive gas.[3]

While there is some tension between ASM’s positions regarding the two patents, they are not completely at odds. As ASM points out, the invention described in the Raaijmakers application does not require removal of the first reactant gas from the reaction chamber before the second reactant gas is introduced into the chamber. One of the problems the invention sought to address was the time delay caused by evacuating the reaction chamber between pulses of reactant gases. (Gasner ’590 Decl., Ex. 13 at 2:22-26.) The invention described in the Raaijmakers application uses sequential pulses of reactants in a flow of carrier gas, delivered with sufficient intervening delay times to minimize undesirable reaction between reactants in adjacent pulses in the gas phase. (Gasner ’590 Decl., Ex. 13 at 24:1-8.) “The use of reactant pulses separated in time and space in a carrier gas flow significantly increases the speed of processing because intervening chamber pump down steps are not required.” (Id. 4:17-19.) In the invention described in the Raaijmakers application, there is no requirement that the reaction chamber be evacuated between pulses. In fact, one of the figures in the application explicitly shows that the first reactant gas has not yet left the chamber when the second reactant gas is introduced. (Gasner ’590 Decl., Ex. 13 at 5:7-22; Sun ’590 Reply Decl. Ex. 3, Fig. 3B).

---

[3] Genus also argued that ASM should be judicially estopped from taking any position on the ’590 and ’365 patents that is inconsistent with the argument they made about those patents to the Patent Office in the Raaijmakers application. This argument was based primarily on the fact that the Patent Office had issued a Notice of Allowance on the Raaijmakers application, and thus ASM purportedly had obtained a benefit from its different interpretations of the ’590 and ’365 patents. As explained above, the representations made to the Patent Office are not inconsistent with ASM’s position here. Moreover, this argument is now moot because ASM filed a Request for Continued Examination of the Raaijmakers application on June 14, 2002. The Court is disappointed that ASM failed to bring this to the Court’s attention (or to Genus’ attention) promptly, for example at the June 17, 2002 claim construction hearing, before the Court and Genus had expended time on a moot issue.

Thus, the language cited by Genus does not necessarily focus on a distinction between "evacuation" and using a carrier gas to remove reactants from the reaction chamber. It can be read as an attempt to demonstrate that the invention described in the application, unlike the inventions described in the '590 and'365 patents, does not require that each reactant be removed from the reaction chamber before the next pulse of reactant gas enters the chamber.

Genus also points to a statement in Raaijmakers' recent deposition in this case, which Genus contends shows that until this litigation began, Raaijmakers associated the term "evacuate" with "pump-down." Raaijmakers testified:

> I've gone through a process where initially I have thought evacuation to mean pump-down, whereas in a period of a year there was mounting evidence that evacuation also included purging. It includes pump-down; it includes purging.

(Sarboraria Supp. Decl. Ex. B at 157:22-158:1.) His purported change of heart was not based on any change in the usage of the term by skilled practitioners in the semiconductor industry, however, and is too akin to a litigation conversion to be entirely persuasive. He also testified equivocally that the use of "evacuate" in different patent applications could have different meanings, and that "I am not sure whether we used the word consistently." (Id. 157:18-20.) Genus points to other recent patent applications filed by Raaijmakers to show that as recently as 2001, Raaijmakers distinguished evacuation from purging. Brown Supp. Decl., Ex. B at ¶ 0080 (describing the use of a gas to purge the reaction chamber, and then noting that "[i]n other arrangements, the chamber may be completely evacuated[.]"); id., Ex. C at ¶ 0060 (similar language). The parties do not dispute that Raaijmakers is a person of ordinary skill in the art. This evidence provides some modest support for Genus' position that "evacuation" does not include using a non-reactive gas to purge the reaction chamber of reactant gases.

Countering with its own extrinsic evidence, ASM points to a November 7, 2000 email from Ofer Sneh, who was then a vice president at Genus, and general manager of its atomic layer deposition group. In evocative prose, Sneh wrote that he had just finished a "painful word by word reading" of the '590 patent, and thought that it claimed "the horizontal flow idea with a bunch of obscured engineering solutions." (Sun '590 Reply Decl., Ex. 4.) ASM argues that this statement goes against Genus' contention that "evacuation" must mean using a vacuum pump to pull the reactants from the chamber. Sneh is not opining about the meaning of "evacuate," however, but is discussing the '590 patent as a whole. Each of the claims of the '590 patent requires (1) evacuation of the reaction space by connecting the reaction space to a vacuum pump and (2) feeding an inactive gas into the reaction space simultaneously with the evacuation step. This combination of feeding an inactive gas into the reaction space while pulling the reactants out with a vacuum pump is essentially a hybrid of the vacuum pump-down and horizontal flow methods. ASM also points to Sneh's deposition testimony, but Sneh testified at deposition that "[a] pump-down system is a flow system, too, and it's all in the same direction[.]"

(Sun Supp. Decl. Ex, 6 at 65:5-6.) Thus, ASM's contention that when Sneh referred to a "horizontal flow idea," he was necessarily distinguishing that concept from a pure pump-down system is unpersuasive.

ASM also cites the deposition testimony of Carl Galewski, Genus' former Director of Strategic Technologies. In discussing his own patent, United States Patent No. 6,398,954, Galewski was asked to interpret the phrase, "After ALD of the barrier layer 401, the barrier layer precursors are evacuated through the CVD process tool 500." (Sun Supp. Decl. Ex. 5 at 52:11-14.) He testified that "evacuated means removed in this case." (Id. 52:24-25.) When asked whether the precursors could be removed with a pump down step or a purge gas, Galewski responded: "Well, I'm speculating. If – again, it calls for some speculation, you know, only reading this section; but evacuation can be purging the chamber or the pressure – I mean pumping the chamber down or maybe a combination of the two." (Id. 53:14-19.) Later in the deposition, when asked whether the precursors could be evacuated with a pump down step, Galewski testified:

> [Y]ou can do that by pumping it down or flushing it with an inert gas or maybe a combination of the two. And they're all commonly used in the industry. Either steps or a combination of the two.

(Id. 57:1-12.) Late in the deposition, on examination by Genus' counsel, Galewski was asked what the word "evacuate" is ordinarily used to mean in the semiconductor industry. (Sarboraria Supp. Decl. Ex. C at 241:24-25.) Galewski responded that "the ordinary meaning of it would be a pump down." (Id. 242:4-5.) He also testified that he used the term "evacuate" in a broader sense in the section of the patent discussed above. (Id. at 242:6-243:2.) No party has argued that Galewski is not a person of ordinary skill in the art. Thus, although Galewski's testimony supports Genus' position that "evacuate" means "pump-down," it also supports ASM's contention that "evacuation" can be used by persons of ordinary skill in the art as a general term meaning "removal," which can be accomplished by pump-down, purging, or a combination of the two.

In general, the extrinsic evidence supports the Court's conclusion, from reviewing the intrinsic evidence, that evacuation is accomplished by using a vacuum pump to suck the gases out of the reaction space. The vacuum pump does not operate at the same rate throughout the process, as may be the case in a pure gas flow system, but must operate at a higher intensity during the evacuation step. Evacuation does not encompass using an inert gas to push the gases out of the reaction space. There is no requirement that the pressure always drop in the reaction space during evacuation, however, because the claims of the '590 patent require simultaneously feeding in an inert gas to push the gases out of the reaction space.

Disputed Claim Language	ASM's construction	Genus's construction
Reaction space	The space encompassing both the reaction chamber, as well as the gas inflow/outflow channels communicating immediately with the reaction chamber.	The entire volume to be evacuated between two successive vapor-phase pulses. It includes the reaction chamber as well as the gas inflow/outflow channels communicating immediately with the reaction chamber.

Here, the parties agree that "reaction space" is expressly defined in the specification, but argue over how much of that definition actually is necessary to define the term. The specification provides:

> According to the invention, the term "reaction space" includes both the space in which the substrate is located and in which the vapor-phase reactants are allowed to react with the substrate in order to grow thin films, namely, the reaction chamber, as well as the gas inflow/outflow channels communicating immediately with the reaction chamber, said channels serving for admitting the reactants into the reaction chamber, inflow channels, or removing the gaseous reaction products of the thin-film growth process and excess reactants from the reaction chamber, outflow channels. . . . According to the invention, the reaction space is the entire volume to be evacuated between two successive vapor-phase pulses.

('590 patent 4:29-43.) ASM argues that "reaction space" should not be construed to include the last sentence of this definition, on the ground that it would be confusing, tautological, subjective, and unhelpful.

It appears that ASM's concern is that the reaction space should be described in terms of a physical description of its boundaries, rather than by describing it by volume of space to be evacuated. The specification clearly defines the term both ways, however, and for good reason. Without the last line of the definition, it is not clear whether there is any limitation on the amount of the inflow and outflow channels that are included in the reaction space. With the last line included, it becomes clear that only the portions of the inflow and outflow channels that are evacuated of reactants between pulses are included in the reaction space.

The specification provides that the different reactant gases are not permitted to mix in the inflow

United States District Court
For the Northern District of California

channels or in the reaction space. ('590 patent 5:10-15.) In order to prevent this, there must be some sort of valves or baffles on the inflow channels that control the flow of reactant gases into the reaction space. (See, e.g., '590 patent 6:19-22.) The location of those valves or baffles defines the limit of the reaction space on the input end. The limit of the reaction space on the output end must be either the vacuum pump itself, or any exhaust valve or baffle through which the vacuum pump draws the reactant gases out of the reaction space.

Accordingly, the Court agrees with Genus that the last sentence of the specification's definition of "reaction space" must be included in order to clearly define the limits of the reaction space. Thus, the reaction space includes the reaction chamber as well as the gas inflow/outflow channels communicating immediately with the reaction chamber, and includes the entire volume to be evacuated between two successive vapor-phase pulses.

Disputed Claim Language	ASM's construction	Genus's construction
Substantially all of said reactants remaining in said reaction space and adsorbed on inner walls of said reaction space are removed to a level of less than 1% prior to the inflow of a second pulse	The gas volume of the reaction space containing reactive gas, as well as the unreacted reactants adsorbed on the inner walls of the reactant space, are removed essentially entirely between two successive vapor-phase pulses, that is, to a level of less than one percent, so that reactant pulses of different starting materials remain isolated from each other and no substantial mixing of the reactants can occur within the reaction space, thereby substantially avoiding conventional CVD reactions within the reaction space.	The claim language is indefinite (i.e. it fails to comply with 35 U.S.C. § 112 ¶ 2.)

Genus has not proposed a claim construction of this claim language, instead arguing that the Court should find it indefinite as a matter of law and thus invalid under 35 U.S.C. § 112 ¶ 2. ASM argues that invalidity is a separate issue from claim construction and thus the Court should defer a finding on invalidity for indefiniteness until a later date.

"The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention." 35 U.S.C. §112 ¶2. The definiteness requirement of 35 U.S.C. § 112 ¶ 2 "is essentially a requirement for precision and definiteness of claim language." PPG Industries, Inc. v. Guardian Industries Corp., 75 F.3d 1558, 1562 (Fed. Cir. 1996) (quoting In re Borkowski, 422 F.2d 904, 909 (C.C.P.A. 1970)). The language of the claims must make it clear what subject matter they encompass. Id. (quoting In re Hammack, 427 F.2d 1378, 1382 (C.C.P.A. 1970)).

Indefiniteness is a matter of law. Personalized Media Communications v. International Trade Commission, 161 F.3d 696, 702 (Fed. Cir. 1998). Determining whether a claim is definite requires an analysis of whether a person of ordinary skill in the art would understand the bounds of the claim when read in light of the specification. Id. at 705 (quoting Miles Lab., Inc. v. Shandon, Inc., 997 F.2d 870, 875 (Fed. Cir. 1993)). "If the claims read in light of the specification reasonably apprise those skilled in the art of the scope of the invention § 112 demands no more." Id.

There is some ambiguity in the case law as to whether a finding of indefiniteness should occur during claim construction, or whether it should occur at a later step. In Intervet America, Inc. v. Kee-Vet Laboratories, 887 F.2d 1050, 1053 (Fed. Cir. 1989), the Federal Circuit, in discussing claim construction, stated that "[a]mbiguity, undue breadth, vagueness, and triviality are matters which go to claim *validity* for failure to comply with 35 U.S.C. § 112-¶ 2, not to interpretation or construction." The Markman decision itself quoted this precise language, albeit in a passage explaining why extrinsic evidence should not be routinely considered in construing claims. Markman, 52 F.3d at 986.

More recent cases, however, have held that a determination of indefiniteness is intertwined with claim construction. "The question of whether claims meet the statutory requirements of § 112 ¶ 2 is a matter of construction of the claims, and receives plenary review on appeal." S3 Inc. v. Nvidia Corp., 259 F.3d 1364, 1367 (Fed. Cir. 2001). See also Atmel Corp. v. Information Storage Devices, Inc., 198 F.3d 1374 (Fed. Cir. 1999) ("[A]n analysis under § 112, ¶ 2 is inextricably intertwined with claim construction[.]"; Personalized Media Communications, 161 F.3d at 705 ("A determination of claim indefiniteness is a legal conclusion that is drawn from the court's performance of its duty as the construer of patent claims."). In two of these cases, however, indefiniteness was considered in the context of a motion for summary judgment; in the third, it was considered after a full factual investigation by the United States International Trade Commission. The Court concludes that the Federal Circuit's statements that indefiniteness is intertwined with claim construction mean only that the Court must attempt to determine what a claim means before it can determine whether the claim is invalid for indefiniteness, and not that the Court must determine indefiniteness during the claim construction proceedings.

In addition, a party seeking to invalidate a claim for indefiniteness has the burden of proving invalidity by clear and convincing evidence. North American Vaccine, inc. v. American Cyanamid Co., 7 F.3d 1571, 1579 (Fed. Cir. 1993). Genus has not even filed a motion seeking to invalidate any of the claims of the '590 patent on the basis of indefiniteness, but simply asserts its arguments in its opposition claim construction brief. This is not a preferable procedure.

Genus' arguments about indefiniteness are also somewhat entangled in issues relating to lack of enablement under § 112 ¶ 1. Genus' first argument is that it is technologically impossible for one of ordinary skill in the art to determine if more than 99% of the reactant residues are removed from the reaction space. In essence, Genus is arguing that the '590 patent does not, and cannot, teach how to measure whether the reactant residues are removed to a level of less than 1%. "Although not explicitly stated in section 112, to be enabling, the specification of a patent must teach those skilled in the art how to make and use the full scope of the claimed invention without 'undue experimentation'." In re Wright, 999 F.2d 1557, 1561 (Fed. Cir. 1993) (citations omitted). "Even if the written description does not enable the claims, the claim language itself may still be definite." Union Pacific Resources Co. v. Chesapeake Energy Corp., 236 F.3d 684, 692 (Fed. Cir. 2001). Thus, if a person of ordinary skill in the art can determine what the claim language means, but the specification does not show how to perform the invention, the claim may be invalid for lack of enablement, not for indefiniteness. Because analysis of enablement focuses on the adequacy of the specification in teaching a person of ordinary skill in the art how to make and use the invention, it cannot be considered to be part of claim construction.

For these reasons, the Court will not consider Genus' arguments about invalidity of the claims for indefiniteness in this claim construction proceeding. Genus may raise these arguments in a summary judgment motion at a later date.

Turning back to claim construction, the Court first notes one area of agreement between the parties. Although the parties once disagreed on the meaning of "adsorbed," they now agree that "adsorbed" means "adhered to the surface." At the claim construction hearing, some potential disputes arose as to whether this included both chemisorbed and physisorbed material. As this issue was not briefed, the Court declines to resolve it at this time. The Court notes, however, that the patent does not make any explicit distinction between chemisorbed and physisorbed material.

The parties' area of disagreement is over the meaning of the phrase "removed to a level of less than 1%." Genus argues that this language can be measured in two different ways, depending on whether or not the gas reactants are considered together with the adsorbed reactants, and that there is nothing to indicate which way is actually meant. The two methods Genus identifies are:

1. The total amount of reactants present either adsorbed on the inner walls or in the gas phase in the reaction space when the evacuation step ends is less than 1% of the total amount present when the evacuation began; or

2. The amount of reactants adsorbed on inner walls when the evacuation step ends is less than 1% of the amount of reactants adsorbed on inner walls when the evacuation step begins, <u>and</u> the amount of reactants in the gas phase in the reaction space when the evacuation step ends is less than 1% of the amount of reactants in the gas phase in the reaction space when the evacuation step begins.

ASM argues that the person of ordinary skill in the art would recognize that the first method of calculation is the appropriate one. ASM is correct. The specification notes that one of the problems the patent seeks to address is preventing the premature mutual reactions of the reactant gases, which can cause unwanted chemical vapor deposition ("CVD") film formation and dust. ('590 patent 7:57-64.) Simply keeping the gases separate is not enough "because mixing may also occur due to adherence of molecules from a starting material pulse on the apparatus walls or discontinuities thereof, wherefrom the molecules may then gain access with the molecules of the successive starting material pulse." (<u>Id</u>. 3:13-19.) Therefore, before introducing the next reactant gas, it is important to try to remove not only the reactant gas vapors, but also the molecules that are adsorbed on the walls. Both the gaseous molecules and the adsorbed molecules can react with the next reactant gas. Thus, there is no reason to differentiate between and separately measure the amount of gaseous molecules removed from the reaction space from the amount of adsorbed molecules removed from the reaction space; the point is to try to remove substantially all of them.

The Court generally agrees with ASM about the appropriate construction of this claim language, although it finds that ASM's proposed construction is unnecessarily verbose. Instead, the Court adopts the following construction: "More than 99% of the combined total amount of the unreacted reactants remaining in the reaction space and those adsorbed on the inner walls of the reaction space are removed before the inflow of a second pulse."

B. The '365 patent

The '365 patent is entitled "Sequential Chemical Vapor Deposition." ASM asks the Court to construe the following terms from the claims of the '365 patent. All of the disputed terms appear in claim 1, which claims:

> A process of growing a thin film by a sequential chemical vapor deposition process, comprising the steps of:
>
> placing a part in a chamber;
>
> evacuating the chamber of gases;
>
> exposing the part to a gaseous first reactant, including a non-semiconductor element of the thin film to be formed, wherein the first reactant adsorbs on the part;
>
> evacuating the chamber of gases;
>
> exposing the part, coated with the first reactant, to a gaseous second reactant of radicals, wherein the radicals convert the first reactant on the part to one or more elements, wherein a thin film is formed; and
>
> evacuating the chamber of gases.

('590 patent 11:41-12:4.)

ASM asks the Court to construe the following terms from the claims of the '365 patent.

Disputed Claim Language	ASM's construction	Genus's construction
A sequential chemical vapor deposition process	The process commonly referred to as Atomic Layer Deposition.	A chemical vapor deposition process using the steps listed in the body of the claim in sequence.

ASM argues that "sequential chemical vapor deposition" refers to any atomic layer deposition process, as opposed to a chemical vapor deposition process. Genus argues that it refers to a chemical vapor deposition process using the steps listed in the claim in sequence.

The '365 patent itself, which is entitled "Sequential Chemical Vapor Deposition," defines the term "sequential chemical vapor deposition." Column 1 of the patent describes the background of the invention by setting forth some of the prior techniques in the field. The background section first describes chemical vapor deposition ("CVD") reactors, in which a steady flow of reactive gases are exposed to the substrate. ('365 patent 1:14-37.) One problem with CVD reactors is that if the reactive gases are allowed to mix for too long a period of time, "gas phase reactions can occur, and in extreme cases there can be gas phase nucleation and particles formed rather than deposition of continuous films." (Id. 1:26-29.)

The patent next addresses atomic layer epitaxy ("ALE"), as described in United States Patent 4,058,430, in which the reactants, which are evaporated gaseous elements, are introduced separately into the chamber containing the substrate. (Id., 1:53-2:2.) The patent then discusses an improvement to that technique, as set forth in United States Patent No. 4,389,973 ("the '973 patent"). (Id. 2:3-18.) This discussion introduces the term "sequential chemical vapor deposition." In describing the technique of the '973 patent, the '365 patent states:

> Their films were grown from gaseous compounds rather than evaporated elements so the process more closely resembles CVD. This was recognized to be especially advantageous when one component of the desired film is a metal with low vapor pressure, since evaporation of metals is a difficult process to control. With this approach, films were deposited by flow reactors similar to a conventional CVD reactor, where the excess of each gas is removed by flowing a purge gas through the reactor between each exposure cycle. This approach was limited to only a few films, depending on the available gaseous precursors, and all of these films were not as contamination free as desired. We will refer to this process as sequential chemical vapor deposition.

(Id. at 2:5-18.) The patent then goes on to describe an alternative method of operating a sequential chemical vapor deposition reactor, in which the excess gaseous compound of each sequence is removed by vacuum pumps, rather than by flowing a purging gas through the reactor. (Id. at 2:19-27.) Finally, the patent discusses several studies which also used sequential chemical vapor deposition methods. (Id. at 2:28-62.)

Although the definition certainly could be set forth more clearly, the Court agrees with ASM that the patent is using "sequential chemical vapor deposition" as a synonym for ALE (which is also referred to interchangeably as ALD). The patent distinguishes ALE/ALD processes, in which reactant gases sequentially react with the substrate, from CVD processes, in which the reactant gases simultaneously react with the substrate. This definition is confirmed by the language of the claims of the '365 patent, each of which claims a "sequential chemical vapor deposition" process in which gases are introduced separately into a reaction chamber to avoid mixing. (Id. at 9:51-12:39.) Because each of these claims identifies a process in which gases are separately introduced into the reaction chamber, it would make no sense to define "sequential chemical vapor deposition" as CVD, as Genus proposes, since CVD processes, by definition, mix the reactant gases in the reaction chamber.

The Court further disagrees with Genus that defining "sequential chemical vapor deposition" as ALD would introduce new limitations into the claims. The issue before the Court is how the patent defines "sequential chemical vapor deposition." The Court finds that a careful reading of the specification demonstrates that the patent's use of "sequential chemical vapor deposition" was intended to be a synonym for ALD. Thus, defining "sequential chemical vapor deposition" as ALD simply corresponds with how the specification itself defines the term.

The extrinsic evidence also supports ASM's construction. The inventor of the '365 patent, Arthur Sherman, testified at deposition:

> [W]hat I mean by sequential chemical vapor deposition is an ALD, atomic layer deposition, whatever you want to call it, process, which involves several expose – one – you know, two exposures, for example, and – as described in the body of the claim, and then repeating it for a long time to get the thickness film you want.

(Gasner Decl., Ex. 14 (Sherman Dep.) 196:5-15. Sherman also testified that chemical vapor deposition does not have to take place. (Id. 196:1-4.)

ASM's expert Alexander Glew states in his expert report that one of ordinary skill in the art would interpret "sequential chemical vapor deposition" to mean the ALD process, because of the patent's citation of both the '973 patent and the M. Leskela article, Atomic Layer Epitaxy in the Growth of Polycrystalline and Amorphous Films, as examples of sequential chemical vapor deposition. (Glew Expert Report at 10.)

Genus' expert, William Oldham, states in his expert report that one of ordinary skill in the art would understand "sequential chemical vapor deposition" to refer to a chemical vapor deposition process that uses a series of steps that occur in a particular order. (Oldham '365 Expert Report at 3.) The Court rejects this opinion, as the patent itself expressly distinguishes chemical vapor deposition from the process at issue in the '365 patent. ('365 patent 1:13-2:27.) Oldham does not dispute Glew's argument that the examples of sequential chemical vapor deposition set forth in the patent are ALD processes.

Moreover, Genus concedes in its opposition brief that the '365 patent "is one of many patents directed at a class of deposition processes known as ALD" (Opposition brief at 2), and "is generally directed at the field of ALD" (id. at 7).

Accordingly, the Court adopts ASM's construction of "sequential chemical vapor deposition" and construes the term as "the process commonly referred to as Atomic Layer Deposition."

The Court agrees with Genus, however, that the elements of claim 1 and 16 (and their dependent claims) must be performed in the sequence listed.[4] Although the sequence of elements does not involve the definition of claim terms, the Federal Circuit has held that it is nonetheless a matter for claim construction. See, e.g., Mantech Environmental Corp. v. Hudson Environmental Services, Inc., 152 F.3d 1368, 1375-76 (Fed. Cir. 1998); Loral Fairchild Corp. v. Sony Corp., 181 F.3d 1313, 1321-22 (Fed. Cir. 1999); Interactive Gift Express, Inc. v. Compuserve Inc., 256 F.3d 1323,1342-43 (Fed. Cir. 2001). "Unless the steps of a method actually recite an order, the steps are not ordinarily construed to require one." Id. at 1342 (citing Loral, 181 F.3d at 1870). "However, such a result can ensue when the method steps implicitly require that they be performed in the order written." Id. (citing Loral, 181 F.3d at 1322 and Mantech, 152 F.3d at 1376). In Loral, the issue was whether steps three and four needed to be performed in order. Loral, 181 F.3d at 1321. Those steps were:

> [3] forming a first insulation layer over said plurality of first gate electrodes;
>
> [4] forming implanted barrier regions in said semiconductor substrate in the intervals between said plurality of spaced-apart first gate electrodes, the edges of said implanted barrier regions being aligned with the vertical edges of the insulation layer on the respective first gate electrodes.

Id. The Federal Circuit found that the district court correctly construed the claim to require that these steps be performed in sequence. Id. In order to align the implanted barrier regions with the vertical edges of the

---

[4] Claim 16 is:

> A process of growing a thin film by a sequential chemical vapor deposition process, comprising the steps of:
>
> placing a part in a chamber;
>
> evacuating the chamber of gases;
>
> exposing the part to a gaseous first reactant, containing a metallic element, where in the first reactant adsorbs on the part;
>
> evacuating the chamber of gases;
>
> exposing the part, coated with the first reactant, to a gaseous second reactant of radicals, wherein the radicals convert the first reactant on the part to a metallic element; and
>
> evacuating the chamber of gases.

insulation layer, the insulation layer must already be in place. Id. The court found that the specification and prosecution history also supported that construction. Id.

Similarly, here, the steps of independent claims 1 and 16 (and their dependent claims) must be performed in order. In both claims, the part must be placed in the chamber before it can be exposed to a gaseous first reactant. Similarly, before "exposing the part, coated with the first reactant, to a gaseous second reactant of radicals," the part obviously must already be in the chamber, and already have been coated with the first reactant. Thus, as in Loral, the claims themselves clearly specify a particular order.

The specification supports this construction. As Genus points out, Figure 2, which illustrates a process cycle, shows the steps occurring in the same order as in claims 1 and 16. The two parts of the text of the specification that describe the process also describe the steps in the same order that they are listed in claims 1 and 16. ('365 patent 6:26-42, 7:49-59.) The inventor's description of the invention in the prosecution history also contains the same sequence of steps. (Sarboraria Decl., Ex. D at FH055.) Because "the sequential nature of the claim steps is apparent from the plain meaning of the claim language and nothing in the written description suggests otherwise," Mantech, 152 F.3d at 1376, the Court agrees with Genus that the steps of claims 1 and 16 (and their dependent claims) must be performed in order.

This order, however, applies only to the first cycle in the process. The '365 patent contemplates that once the second gaseous reactant is evacuated, "[t]he process cycle can be repeated to grow the desired thickness of film." ('365 patent 5:19-22, 6:42-43.) In ALD process in general, "[t]he desired film thickness is built up by repeating the process cycle many (e.g., thousands) times." (Id. 2:1-2.) The Court agrees with ASM that the invention does not contemplate, for example, that the substrate would be removed and placed back in the chamber between cycles, nor that the chamber be evacuated twice after the introduction of the second gaseous reactant. Figure 2 of the '365 patent, in fact, shows the step immediately after evacuation of the second reactant gas as exposure to the first reactant. Thus, after the second gaseous reactant has been evacuated, the second and all future cycles would begin again at "exposing the part to a gaseous first reactant." Genus does not appear to disagree with the Court on this point.

Disputed Claim Language	ASM's construction	Genus's construction
Evacuating the chamber of gases	Removing reactant gases from the chamber.	Reducing the pressure in the chamber with a vacuum pump to remove the gases.

As with the ’590 patent, the parties dispute whether evacuating the chamber of the reactant gases requires a vacuum pump, or should be more broadly construed to encompass any method of removing the reactant gases from the chamber.

There are only five places in the specification of the ’365 patent that discuss evacuation. Twice during the discussion of the ’430 patent, the specification states that the excess gaseous reactants are removed by “evacuating the chamber with a vacuum pump.” (’365 patent 1:59-60; 1:67.) The other three uses of the word appear during the description of the preferred embodiment illustrated by Figures 1 and 2, where the specification repeatedly states that the reactor vessel is evacuated with a vacuum pump. (Id. 6:26-43.) Thus, the only explicit mentions of “evacuation” in the specification all refer to the use of a vacuum pump. The ’365 patent’s description of the flow system of the ’973 patent does not use the word “evacuate,” but instead states that in the invention of the ’973 patent “the excess of each gas is removed by flowing a purge gas through the reactor between each exposure cycle.” (Id. 2:12-14.)

The abstract of the ’365 patent twice states that the excess reactants are removed by a pump. (’365 patent, Abstract). The summary of the invention describes only one embodiment, in which pumps are used to remove excess reactants. (’365 patent 5:9-20.) Figure 1 which describes one preferred embodiment, shows a vacuum pump to evacuate gases, and does not show any other method of emptying the chamber. (’365 patent 5:53-6:25.) Genus’ expert, Dr. Oldham, also opines that a person of ordinary skill in the art would understand clearly that the specification’s description of a chamber that is sealed with O-rings, flanges and valves describes a non-flow vacuum system. (Oldham ’365 Expert Report at 6.) Similarly, Figure 2, which illustrates a process cycle, employs a vacuum pump. (’365 patent 6:27-43.) Figure 3, which describes another preferred embodiment, also shows no way of emptying the chamber other than by use of a vacuum pump.[5] The only other section of the specification where removal of the gases from the reaction chamber is mentioned in the context of the invention of the’365 patent also discusses the use of a pump to remove the gases. (’365 patent 7:52-59.)

In sum, the ’365 patent uses the term “evacuate” only to describe removal of gases with a vacuum

[5] Although the inventor, Arthur Sherman, testified at deposition that the radical generator and the vessels for the first reactant could be used to introduce inert gases into the chamber, he acknowledged that he did not describe that use in the patent. (Gasner Decl., Ex. 14, Sherman Dep. 65:7-16.)

pump. In addition, every description of the removal of excess reactant gases in the context of the invention of the '365 patent also mentions the use of a vacuum pump.

ASM argues that because the '365 patent defines "sequential chemical vapor deposition" by reference to '973 patent, which does not use a vacuum pump to remove excess reactants, the patent is using "evacuation" broadly enough to encompass the method of the '973 patent. Although the Court agrees that "sequential chemical vapor deposition" is used broadly enough to encompass the '973 patent, it does not necessarily follow that "evacuation" is used so broadly. In fact, the claims define specific types of sequential chemical vapor deposition processes, in each of which the chamber is evacuated of gases. Nothing in the patent language itself suggests that "evacuation" is accomplished in any way other than by using a vacuum pump.

Other language in the claims also demonstrates that "evacuation" cannot performed with a purging gas. Claims 1 and 16, and their dependent claims, all require "evacuating the chamber of gases" immediately after inserting the part into the reaction chamber, before any reactant gases are introduced into the chamber. (Id. 9:55, 11:13.) Thus, the gases that must be evacuated cannot be limited to the reactant gases, but must include all gases in the chamber. The same language, "evacuating the chamber of gases," is used in each claim after the first reactant gas is introduced into the chamber, and after the second gas is introduced into the chamber. To be consistent, each step must require removal of all gases from the chamber, not just the reactant gases. Genus' expert, Dr. Oldham, states in his expert report that one of ordinary skill in the art would know that removal of all of the gases in the chamber would require a reduction of pressure in the chamber with a vacuum pump. (Oldham '365 Expert Report at 5.) If a purging gas is used to remove the reactant gases from the chamber, the purging gas obviously is in the chamber, and the chamber is not evacuated of all gases. Thus, this language also supports Genus' argument that evacuation must be used to refer to removal of gases with a vacuum pump.

ASM argues, to the contrary, that "evacuation" is just a synonym for "removal" because the patent specification describes both "evacuating the chamber with a vacuum pump" and "remov[ing] by vacuum pumps." (See, e.g., '365 patent 1:59-60, 2:22.) The prosecution history has similar language. (See, e.g., Sarboraria Decl., Ex. D at '365 FH-055.) This argument is unpersuasive. It is not disputed that by evacuating the chamber of gases, one is removing the gases from the chamber. The question is whether "evacuation" is limited to one method of removal, specifically, removing the gases with a vacuum pump, or whether it encompasses another method of removal, the use of a purging gas. There is no place in the patent language where using a gas to purge the chamber is referred to as "evacuation."

ASM also argues that because the claims of the '365 patent address processes, rather than apparatuses, they should not be limited to apply only to processes that use vacuum pumps to remove gases from the chamber. The Court's duty, however, is to determine the definition of the claim terms. Based on the intrinsic evidence, the Court concludes that, because the claim terms all use the term "evacuating," the claims are limited to processes in which gases are removed by means of a vacuum pump, and do not encompass processes in which reactant gases are removed by means of a purging gas.

Turning to the extrinsic evidence, Genus points to two 1999 internal memoranda from Raaijmakers, ASM's Chief Technology Officer, to other high ranking ASM executives, in which he discusses whether ASM should purchase the '365 patent from Sherman. (Sarboraria Supp. Decl., Exs. E and F.) In one memorandum, Raaijmakers states:

> In my opinion the claims [of the '365 patent] are restricted to a "classic" ALCVD method, i.e. in which the chamber is pumped down between cycles. The claim does not foresee the use of radicals in a so-called "travelling wave reactor."

(Id., Ex. E.) It is the Court's understanding that a travelling wave reactor uses a continuous flow of gas in which pulses of reactant gases are separated by a flow of non-reactant gas. In the other memorandum, he states "we would not infringe in our traveling wave reactors," but "this could become an argument later." (Id., Ex. F.) The Court interprets these statements as an objective, pre-litigation, opinion that although the claims of the '365 patent cover only methods in which the chamber is pumped down between cycles, the patent might nonetheless be asserted against their traveling wave reactors later if

they did not purchase the rights now. Raaijmakers acknowledged as much at his deposition:

> Q: You understood that – it was your understanding that the ASM reactors that do not perform a pump-down would not fall within the Sherman patent so they didn't need to pay a royalty; correct? I'm not saying that's what this says, but that's what you were understanding when you were making recommendations to senior management of ASM?
>
> A: I recognized it could become an argument. That's probably what becoming the argument is, which is exactly the argument we are talking about now.

(Sun Decl., Ex. 7, Raaijmakers Dep. 125:7-16.)[6]

---

[6] Although Genus' supplemental claim construction brief at two points describes the Raaijmakers deposition testimony discussed in this section as relating to the '590 patent, it actually relates only to the '365 patent. The Court assumes the error was inadvertent.

It is undisputed that Raaijmakers is a person of ordinary skill in the art. These internal memoranda discuss whether ASM should attempt to acquire all rights to the ’365 patent. At that time, ASM had every motive to view the patent carefully and objectively in these internal discussions. The Court finds that these prelitigation admissions by ASM are both reliable and highly probative of how the ordinary person of skill in the art would interpret the claims of the ’365 patent. Raaijmakers’ view of the ’365 patent in this 1999 memorandum is in accord with the intrinsic evidence that “evacuate” means removal by use of a vacuum pump.

At deposition, Raaijmakers testified that “Sherman called me that he had this great invention and he disclosed that it was ALD with radicals and he disclosed also that it was a pump-down.” (Sarboraria Supp. Decl., Ex. B, Raaijmakers Dep. 110:23-25.) Raaijmakers also testified that “I’ve gone through a process where initially I have thought evacuation to mean pump-down, whereas in a period of a year there was mounting evidence that evacuation also included purging.” (Id. 157:22-25.) He now says he believes that “‘evacuate’ could include ‘purge.’” (Id. at 117:24-25.) “‘Evacuate’ in the different applications could have different meanings. I am not sure whether we used the word consistently.” Id. 157:18-20.)

Raaijmakers also testified that his opinion in these memoranda was only based on discussions with Sherman about his preferred embodiment, and were not intended to opine on the scope of the claims of the ’365 patent. (Sun Decl. Ex. 7, Raaijmakers Dep. 104:12-21.)

> I’m not representing what the scope of the claims are; I cannot do that. What I am saying is that in the opinion I formed during my long discussions with Art Sherman where he disclosed repeatedly his preferred embodiment to me, based on that opinion, I thought at that time, okay, he describes a pump-down process.

(Id.) He testified that he was describing the preferred embodiment that Sherman disclosed to him. (Id. 105:16-17.) He acknowledged, however, that he was able to view claims from the perspective of one skilled in the art, and that by using the term “the claims” he was referring to the claims of the patent. (Id. 105:7-9.) He acknowledged that he had read the claims when he prepared the memoranda, and that he made his best effort to understand what the claims covered. (Id. 106:2-22.) Raaijmakers also noted in his deposition that his view of the ’365 patent at the time these memoranda were written was different from Sherman’s view, and that their difference of opinion was over how to interpret the word “evacuate.” (Id. 106:24-108:16.)

Genus points out that, despite Raaijmakers’ current position that “evacuate” is not limited to pumping down with a vacuum, he has filed patent applications as recently as 2001, in which he has distinguished evacuation from purging excess reactants. Brown Supp. Decl., Ex. B at ¶ 0080 (describing the use of a gas to purge the reaction chamber, and then noting that "[i]n other arrangements, the chamber may be completely evacuated[.]"); id., Ex. C at ¶ 0060 (similar language); Id., Ex. D at ¶ 0065. Raaijmakers testified at deposition that his change of opinion about the meaning of "evacuate" was triggered by a statement by the Patent Cooperation Treaty office:

> Sherman mentioned clearly that evacuation included purging, whereas was at the time of this, in September '99, I was of the opinion that it did not.
>
> Later there were PCT applications filed from Sherman, and there was a clear reaction from the PCT office that evacuation included purging, and that made me change my mind.

(Sun Supp. Decl., Ex. 7, Raaijmakers Dep. 152:16-23.) This testimony is apparently a reference to PCT/US00/10267, a PCT written opinion issued on January 26, 2001, which appears to address an international patent application that is a continuation-in-part of the '365 patent. (Sun Supp. Decl. Ex. 2 at ASM 26681.) That opinion, without any written analysis, interpreted "evacuate" in the context of the '365 patent to refer only to purging. (Id. at ASM 26682.) As this opinion is devoid of analysis, the Court is unable to follow the analysis that led to this conclusion, but disagrees with it, for the reasons already set forth in this opinion.

The Court is not persuaded by Raaijmakers' attempt to explain away his earlier view of the '365 patent. Raaijmakers' objective view of the '365 patent before this litigation began, as one skilled in the art, was that "evacuate" meant pump-down, and that, therefore, the '365 patent covered only processes that used a vacuum to pump-down the reaction chamber. The Court finds that view more relevant and persuasive than his current, litigation-driven viewpoint. Raaijmakers' original view is in accord with the Genus' construction of the term "evacuate," and with the way the term is used in the intrinsic evidence.

Genus' expert, Dr. Oldham, states in his expert report that a person of ordinary skill in the art would understand "the claim language 'evacuating the chamber of gases' to mean pumping out the gases in the chamber, that is, reducing the pressure in the chamber with a vacuum pump to effect the removal of the gases." (Oldham '365 Expert Report at 4-5.) ASM's expert, Dr. Glew, states that in the context of the '365 patent, one of ordinary skill in the art would interpret the phrase "evacuating the chamber of gases" to mean "removing reactant gases from the chamber by any number of methods commonly known in the art at the time including but not limited to evacuation through a pressure drop and evacuating by purging with an inert gas." (Glew

Expert Report at 11.) The Court finds Oldham's explanation to be more persuasive, as it is based on a more detailed and careful analysis of the language of the '365 patent than is Glew's opinion.

Genus also points to documents produced by ASM, which appear to be materials used by Sherman to teach a course on atomic layer deposition. (Sarboraria Supp. Decl., Ex. G.) These materials contain a slide that describes ALD reactors as "vacuum pumped systems" and "flow purged systems." (Id. SHE 002281). They also contain a slide entitled "Evacuation vs. Flow Systems," which states that "flow systems use inert gas purging rather than evacuation[.]" (Id. at SHE 002529.) Although Genus contends that these materials predate the litigation, they are undated, and Genus has not submitted any evidence to establish when they were prepared. Nonetheless, these materials suggest that Sherman himself distinguishes between evacuation and purging.

ASM argues that the Court should not consider these slides, citing North American Vaccine, 7 F.3d 1571 at 1578. In that case, the district court erred in limiting the scope of patent claims because of an article and speech in which the inventor discussed his research. Id. at 1578. The Court held:

> A patent is to be interpreted by what it states rather than by what the inventor wrote in a scientific publication.
>
> There is no inconsistency between writing a paper (or giving a speech) on a particular embodiment of an invention and then claiming one's invention more broadly in a patent application.

Id. That case is distinguishable, however, because Sherman's class materials do not address any particular embodiment, but demonstrate that he makes the same general distinction between purging and evacuation that is apparent from a close reading of the intrinsic evidence. The Court is not using the class materials to limit the scope of clear patent claims, but instead is reviewing it to confirm that one of ordinary skill in the art makes the distinction between the two terms that also appears from a close reading of the patent language.

Finally, Genus points to Sherman's inventor notebook for the '365 patent. This document was not used as an exhibit during briefing but only first presented at the claim construction hearing itself. ASM made no objection to the exhibit, however, and thus the Court will consider it. In that notebook, dated May 24, 1996, Sherman wrote:

> An essential requirement of this new process is that it be done in a vacuum chamber, with each step of the process involving a dosing and then an evacuation. It would be much more difficult to do in a flowing system such as used by Suntola in Finland.

(Genus' illustrative exhibit 26, '365 claim construction hearing.) Sherman's inventor notebook also supports the Court's conclusion that the claims of the '365 patent are limited to processes in which the reaction chamber is evacuated with a vacuum pump.

For the reasons set forth above, the Court finds that, on the whole, the extrinsic evidence supports the meaning of "evacuate" that is apparent from the intrinsic evidence. The Court construes "evacuate" in the context of the'365 patent to refer to removal of gases with a vacuum pump. The term does not encompass the use of an inert gas to push gases out of the reaction chamber.

Disputed Claim Language	ASM's construction	Genus's construction
Exposing the part to a gaseous first reactant, including a non-semiconductor element of the thin film to be formed, wherein the first reactant adsorbs on the part	Exposing the part to a reactant gas that includes an element that is not a semiconductor, and that is a component of the non-semiconductor thin film to be formed.	An element that is not a semiconductor and that will be contained in the thin film to be formed.

Here, the dispute is whether the thin film to be formed can be a semi-conductor film. ASM argues that the word "non-semiconductor" should be interpreted as if it were repeated twice in the claim, so that the first reactant must contain a non-semiconductor element of the non-semiconductor thin film to be formed. Genus argues that the plain meaning of the claim language is that the first reactant must contain a non-semiconductor element, but that the thin film to be formed does not have to be a non-semiconductor.

Genus' construction follows the plain meaning of the claim language. ASM argues, however, that a review of the specification demonstrates that the invention was only directed to the creation of non-semiconductor films.

As ASM points out, the specification explains that "[a] continuing problem in the commercial manufacture of integrated circuits is the achievement of conformal deposition of dielectric (e.g., silicon dioxide, silicon nitride) or conducting (e.g., aluminum, titanium nitride) thin solid films over large area wafers[.]" ('365 patent 2:66-3:3.) The Oxford English Dictionary Online defines "dielectric" as "non-conducting." ASM thus contends that the invention is concerned only with conducting or non-conducting films, not semi-conducting films. The language quoted by ASM is not a description of the invention, however, but simply part of a discussion of then-current problems in the commercial manufacture of integrated circuits.

The specification also contains schematic drawings of three preferred embodiments of the invention, one of which is "suitable for the deposition of any film, conducting or non-conducting[.]" (Id. 5:46-47.) ASM contends that this phrase, which does not mention semi-conductor films, also indicates that the invention is not directed towards the creation of semi-conductor films. Nothing in the surrounding text, however, indicates that ASM's reading of this phrase is the correct one. If one were attempting to exclude semi-conductor films, one would be more likely to use the phrase "any conducting or non-conducting film" or "any non-semiconductor film." The use of the phrase "any film" suggests that the drafter intended to include semiconductor films within the range of films from nonconducting to conducting. In other words, "any film" could easily mean "any film." It is a somewhat strained reading to interpret the phrase "any film, conducting or non-conducting" to mean "any non-semiconductor film."

ASM argues that because the specification contains a schematic drawing for a reactor "suitable for the deposition of films that are not electrically conducting" (id. 5:40-41) and another for a reactor "suitable for the deposition of any film, conducting or non-conducting," (id. 5:46-47) that the invention excludes the deposition of semi-conductor films. This argument fails for the same reason stated above.

A more reasonable reading is that one reactor is suitable only for deposition of non-conducting films, and that the other can be used for deposition of any film. There is no language in the specification that expressly excludes semi-conductor films from the scope of the invention, or that indicates that the preferred embodiments cannot be used for the deposition of semi-conductor films.

In fact, the specification begins by stating that "[t]he present invention relates to methods and apparatuses suited to the low temperature deposition of solid thin films of one or more elements by the technique of sequentially exposing the object being coated with chemically reactive gaseous species." (Id. 1:5-9.) The specification also states later that "[i]t is an object of the invention to facilitate the growth of thin films of any element by using a radical generator to make available highly reactive gases (radicals)." (Id. 5:34-36.) The specification also explains that "[t]he process of this invention is unique in that it allows, for the first time, the deposition of perfectly conformal and very pure films of any composition at low temperatures." (Id. 9:34-37.) This repeated use of language that makes no attempt to describe or limit the conductivity or composition of the resulting thin film also suggests that when the specification uses the phrase "any film," it means "any film," not any non-semiconductor film.

ASM also argues that the examples listed at the end of the specification all describe non-conducting or conducting films. (Id. 7:29-9:50.) Again, however, nothing in the specification limits the types of films that the invention can create, or indicates that the invention is not directed to the creation of semi-conductor films. As noted above, the specification specifically states that the invention facilitates the growth of thin films "of any element" (id. 5:34-36) or "of any composition" (id. 9:34-37). The Court rejects Genus' argument that the examples show the formation of semiconductor thin films, however. Examples 1 and 3 do discuss depositing a layer of elemental silicon, which is a semiconductor, but those layers are clearly stated to be only one layer in the formation of non-semiconductor thin films of materials such as silicon dioxide and tantalum/silicon/nitrogen. ('365 patent 7:34-39; 8:18-27.) Claim 1 itself makes clear that the thin film to be formed is created only after the interaction of the second reactant. ('365 patent 9:61-64.) Thus, examples 1 and 3 do not discuss the creation of semiconductor films, but only discuss the deposit of semiconductor layers which are used to create non-semiconductor films.

Moreover, the Court notes that "thin film" is used in two other places in claim 1, both times without any limitation on the type of thin film that is to be formed. The claim begins: "A process of growing a thin film . . . ." (Id. 9:52.) The claim also explains that after the second reactant gas is added to the chamber, the first reactant on the part is converted "to one or more elements, wherein a thin film is formed[.]" (Id. 9:63-64.) The repeated and conspicuous absence in the claim language of any limitation on the type of thin film that is to be formed demonstrates that no such limitation should be imported into the claim. There is nothing at all in the specification that demonstrates that the thin film to be formed must be a non-semiconductor film. In fact, the specification defines "thin film" by expressly noting that it can be "of any element" (id. 5:34-36) or "of any composition" (id. 9:34-37).

ASM argues that the Court should not interpret the claim language according to its plain meaning, and cites cases such as Cultor Corp. v. A.E. Staley Manufacturing Co., 224 F.3d 1328 (Fed. Cir. 2000) and SciMed Life Sys., Inc. v. Advanced Cardiovascular Sys., Inc., 242 F.3d 1337 (Fed. Cir. 2001). Those cases are distinguishable, however, because in both cases, the specification clearly showed that the claim language was being used more narrowly than its plain meaning would suggest. Here, however, nothing in the specification excludes semi-conductor films, and there is language in the specification that explicitly supports Genus' claim that the thin film to be formed can be any film.

The extrinsic evidence is unhelpful. Oldham states in his expert report that a person of ordinary skill in the art "would have understood that this claim language does not require that the 'thin film to be formed' is 'a non-semiconductor.'" (Oldham '365 Expert Report at 8.) Glew states in his report that one of ordinary skill in the art would interpret this language to require that a non-semiconductor film be formed. (Glew Expert Report at 11.) The inventor testified that it was his intent to exclude all semiconductor films. (Gasner Decl., Ex. 14, Sherman Dep. 147:1-25.) The inventor's intent, however, does not control over the unambiguous language of the patent. The inventor cannot "by later testimony change the invention and the claims from their meaning at the time the patent was drafted and granted." Voice Technologies, 164 F.3d at 615.

Finally, ASM contends that the Court should construe the "thin film to be formed" to be a non-semiconductor film in order to preserve the validity of the claim. Although there has been no argument that claim 1 is invalid in light of prior art, ASM asserts that there is prior art that addresses the use of radicals to grow a gallium arsenide film, which is a semiconductor. Without having received any evidence or developed argument about these prior art references, the Court is no position to opine on their effect on the validity of the claims of the '365 patent.

It is true that, where possible, the Court should construe claims to preserve their validity, but "claims can only be construed to preserve their validity where the proposed claim construction is 'practicable,' is based on sound claim construction principles, and does not revise or ignore the explicit language of the claims." Generation II Orthotics Inc. v. Medical Technology Inc., 263 F.3d 1356, 1365 (Fed. Cir. 2001). The problem with ASM's argument here is that the plain language of the claim indicates that the "thin film to be formed" can be any film, and the specification explicitly states that "[i]t is an object of the invention to facilitate the growth of thin films of any element" ('365 patent 5:34-35 (emphasis added)), and "[t]he process of this invention is unique in that it allows, for the first time, the deposition of perfectly conformal and very pure films of any composition at low temperatures." ('365 patent 9:34-37 (emphasis added).) The very first line of the specification after the abstract states that "[t]he present invention relates to methods and apparatuses suited to the low temperature deposition of solid thin films of one or more elements," without limitation as to the type of thin film. There is nothing in the specification that limits the thin film to a non-semiconductor film. Thus, the only way for the Court to construe the claim language to exclude semiconductor films would be to rewrite the claim language, which it may not do. See Apple Computer, Inc.

v. Articulate Systems, Inc., 234 F.3d 14, 24 (Fed. Cir. 2000) (citing Becton Dickinson & Co. v. C.R. Bard, Inc., 922 F.2d 792, 799 and n.6 (Fed. Cir. 1990) (judicial redrafting of claims to preserve validity is impermissible).

Accordingly, the Court agrees with Genus that the phrase "including a non-semiconductor element of the thin film to be formed" should be construed according to its plain meaning: "including an element that is not a semiconductor and that will be contained in the thin film to be formed." The claim contains no limitation on the conductivity of the thin film that is to be formed, and thus does not exclude semiconductor thin films from the scope of the claim.

/ /

/ /

/ /

/ /

Disputed Claim Language	ASM's construction	Genus's construction
A gaseous second reactant of radicals	A second reactant gas that includes radical atoms or molecules, which are highly reactive gas fragments (for example, atoms or molecules produced as a result of a glow discharge) that allow or encourage the desired reaction.	Free radicals, which are highly reactive gas fragments. Genus' expert, Dr. Oldham, defines "free radicals" as "molecules that possess one unpaired valence electron."

The dispute here is over the definition of "radicals." ASM argues that no definition is necessary, but that if the Court chooses to construe the term, it should construe it with reference to the mentions of "radicals" in the specification. ASM argues that Genus' proposed definition of free radicals as "molecules that possess one unpaired valence electron" is clearly wrong, as it is not based on anything in the specification, and would exclude substances that are unquestionably considered "radicals" by persons of ordinary skill in the art. The essence of the argument appears to be whether "radical" means any reactive gas fragment, including ions, or whether "radicals" are only electrically neutral reactive gas fragments.

The '365 patent contains several explanations of the term "radicals." The background portion of the specification provides:

In the 1960's it was realized that we could lower the temperature required for thin film

> deposition at acceptable rates by creating a low pressure glow discharge in the reactive gas mixture. The glow discharge produces many high energy electrons that partially decompose the reactive gases, and these gas fragments (radicals) are very reactive when they impinge on a surface area even at moderate temperatures.

(Id. 1:38-45.) The summary of the invention provides that "the second reactant passes through a radical generator which partially decomposes or activates the second reactant into a gaseous radical before it impinges on the monolayer." (Id. 5:13-16.) The summary of the invention concludes: "It is an object of the invention to facilitate the growth of thin films of any element by using a radical generator to make available highly reactive gases (radicals)." (Id. 5:34-36.)

The only relevant portion of the file history that the parties have cited discusses the '365 patent in relation to United States Patent No. 5,693,139 ("Nishizawa"):

> Nishizawa fails to recognize the necessity for the second reactant to contain free radicals. . . . The present invention recognizes the value of using a second reactant containing free radicals which react to remove the undesired elements of the first reactant adsorbed to the part, at low temperature, without also desorbing the desired elements of the first reactant monolayer.

(Sarboraria Decl., Ex. D ('365 patent file history) at 58.) This discussion is unhelpful in defining the term "radical," however, as it appears to be undisputed that "free radical" and "radical" are interchangeable terms. For example, the definition of "free radical" in the McGraw-Hill Dictionary of Scientific and Technical Terms states: "Also known as a radical." (Sarboraria Decl., Ex. L.)

ASM's expert, Alexander Glew, attests that:

> The Genus construction of radicals, as free radicals with unpaired electrons, is incorrect and does not cover many known radicals. The '365 patent specification makes mention of methods, such as a glow discharge or plasma, of producing these radicals that would not be covered under the Genus construction. For example, the halogens cited in the '365 patent such as chlorine, bromine, fluorine, iodine, and astatine acquire an extra electron and fill their valence shell. The resulting radical is a negatively charged ion with a completed valence shell and no unpaired electrons. Other atoms and molecules may be stripped of electrons, resulting in no unpaired electrons in their valence shell, yet still be encompassed within the definition of radicals as known by those skilled in the art and as described in the '365 patent.

(Glew Expert Report at 13.) It is unclear to the Court, however, where Glew believes the '365 patent cites to halogens such as chlorine, bromine, fluorine, iodine, and astatine.

A patent assigned to Genus, United States Patent No. 6,305,314 ("the '314 patent") defines "radical" as follows:

> The term radicals is well-known and understood in the art, but will be qualified again here to avoid confusion. <u>By a radical is meant an unstable species</u>. For example, oxygen is stable in diatomic form, and exists principally in nature in this form. Diatomic oxygen may, however, be caused to split to monoatomic form, or to combine with another atom to produce ozone,

> a molecule with three atoms. Both monotonic oxygen and ozone are radical forms of oxygen, and are more reactive than diatomic oxygen.

(Gasner Decl., Ex. 3, '314 patent 6:5-13 (emphasis added).) The patent also explains that:

> Radical species, as introduced above, are reactive atoms or molecular fragments that are chemically unstable and therefore are extremely reactive. . . . Radicals may be created in a number of ways, and plasma generation has been found to be an efficient and compatible means of preparation.

(Id. 7:14-20.) Sneh, one of the inventors of the'314 patent, testified at deposition that radicals are electrically neutral. (Sun Decl., Ex. 6, Sneh Dep. 174:16-18.)

Galewski, the other inventor of the '314 patent testified that the ordinary meaning of "radical" in the semiconductor industry is atoms or clusters of atoms with unpaired electrons. (Sun Decl., Ex. 5, Galewski Dep. 74:12-75:4.; Sarboraria Supp. Decl., Ex. C, Galewski Dep. at 243:10-16.) Galewski also testified, however, that in the real world, "if I have something that generates something that's reactive, I may look at that as a radical, in a simple explanation." (Sun Decl., Ex. 5, Galewski Dep. 76:8-11.) According to Galewski, there is no need to know whether the reactive element was a radical, "[b]ecause the end result is what we care about." (Id. 77:3-4.) Galewski also testified that ions are not reactive by themselves, and "are actually quite stable and happy because the electronic shell's structure is satisfied." (Id. 82:9-20.)

Genus' expert, William Oldham, does not actually dispute Glew's statement that radicals need not have an unpaired valence electron. In his expert report, he defines "radicals" as "highly reactive gas fragments," and explains that they are highly reactive because "they typically contain one or more unpaired electrons." (Oldham '365 Expert Report at 9 (emphasis added).) Although Oldham's rebuttal expert report omits the word "typically," he does not expressly dispute Glew's conclusion that certain radicals may not have an unpaired electron.

At least one treatise, in addition to Galewski's testimony, supports Oldham's conclusion that a radical has an unpaired valence electron, however. The McGraw-Hill Dictionary of Scientific and Technical Terms provides two definitions of "free radical":

> [CHEM] An atom or a diatomic or polyatomic molecule which possesses at least one unpaired electron. [ORG CHEM] A species which is uncharged and possesses one or more unpaired electrons. Also known as a radical.

(Sarboraria Decl., Ex. L.) Another treatise states that "[a] radical is a molecular fragment with an odd number of unshared electrons." (Oldham Expert Report, Ex. H, Hart, H., Organic Chemistry, 8th edition (1991) at 13.)

Oldham disputes Glew's conclusion that a negatively charged ion can be considered a radical. "[I]t is well known in the semiconductor art that the word radical is used specifically to identify those atoms or molecular fragments which are highly reactive and which are uncharged: In other words, the term "radicals" specifically distinguishes against ions." (Oldham '365 Rebuttal Expert Report at 5.) Oldham cites several treatises which distinguish ions, which are charged particles, from radicals, which are uncharged. (Id. at 5 (citing Wolf, S. and Tauber, R.N., Silicon Processing for the VLSI Era, Volume I: Process Technology, at 543-44; and Stephan A. Campbell, The Science and Engineering of Microelectronic Fabrication, 2d edition, at 249).)

The Wolf and Tauber treatise defines radicals as "an atom, or collection of atoms, which is electrically neutral, but which also exists in a state of incomplete chemical bonding, making it very reactive." (Sarboraria Decl., Ex. M at 544.) It distinguishes radicals from "charged species, including positive ions, electrons, and negative ions[.]" (Id.)

The Campbell treatise states:

> Dissociated atoms or molecular fragments are called radicals. Radicals have an incomplete bonding state and are extremely reactive.

(Id. Ex. N at 249.) It defines ions as "charged atoms or molecules" which "may have more than one positive charge or may even be negatively charged." (Id.) It also distinguishes radicals from "charged species." (Id.) Both treatises also discuss radicals as components of a plasma or glow discharge, which comports with the specification's explanation that radicals are highly reactive components of a gas that have been created or triggered by a glow discharge.

Sherman, the inventor of the'365 patent, testified at deposition that a radical is:

> either an atom which is an unstable atom – excuse me, oxygen atoms, nitrogen atoms, hydrogen atoms, for example. It could be a molecular fragment such as HN, which you would undoubtedly see if you made a discharge in ammonia, and any other number of molecular fragments. In reality, it could be a metastable atom and could possibly even be an ion.

(Kwun Decl., Ex. 1, Sherman Dep. 122:17-24.) On the other hand, Genus points to a pending patent application in which ASM's Chief Technical Officer, Raaijmakers, distinguishes radicals from ions. (Sarboraria

Decl., Ex. I, at ASM 26068.)

Glew provides no independent support for his contention that radicals can include negatively charged ions. In fact, at his deposition, Glew stated that one could identify which atoms in a plasma are radicals and which are ions, because the ions are charged particles. (Sarboraria Decl., Ex. E, Glew Dep. 218:2-6.) Glew also testified that the chemistry textbook definition of "radical" is that radicals are uncharged, although he also stated that that definition would be slightly different than that to which one practicing in the field would subscribe. (Id. 215:6-12.) Glew also acknowledged that Wolf and Tauber is a semiconductor-oriented publication, and that under the Wolf and Tauber definition, ions are not radicals. (Id 215:13-15, 218:7-12.) It appears that Glew is not disputing that, to a person of ordinary skill in the art, radicals are uncharged particles. His deposition testimony suggests that his concern with the Wolf and Tauber definition in the context of the '365 patent is that the reactive gas fragments that are produced in a glow discharge include both radicals and ions. (Id. 217:12-218:25.) From this testimony, it appears to the Court that Glew believes the '365 patent is defining "radical" broadly to include all reactive gas fragments produced in a glow discharge or radical generator. (See, e.g., '365 patent 1:41-44.) This definition would include ions within the definition of "radical." That definition is different from the standard meaning of "radical" to a person of ordinary skill in the art, however. Oldham argues in his rebuttal expert report that "[i]t would be absurd to suggest[] that everything produced by such generators is a 'radical' because it would mean, for instance, that an electron is a radical." (Oldham '365 Rebuttal Expert Report at 6.)

Because the language of the '365 patent does not clearly redefine the ordinary meaning of "radical" to include ions, the Court does not accept Glew's definition. As Genus has provided several treatises which agree with Oldham that radicals are uncharged, and it appears to be undisputed that the person of ordinary skill in the art would consider radicals typically to be uncharged, the Court agrees with Genus that a radical must typically be electrically neutral and possess at least one unpaired electron. The Court does not find that "radicals" must always be electrically neutral, however, because it appears that persons of ordinary skill in the art may use the term somewhat more loosely than the textbook definition. (See, e.g., Oldham '365 Expert Report at 9; Kwun Decl., Ex. 1, Sherman Dep. 122:17-24; Sun Decl., Ex. 5, Galewski Dep. 76:8-11.)

The parties are in general agreement that a radical is a highly reactive gas fragment. The Court also concludes that a radical is typically electrically neutral and contains one or more unpaired valence electrons.

Should it be necessary to decide whether a particular gas fragment that does not contain an unpaired valence electron may nonetheless be properly referred to as a "radical," the Court will consider that issue at a later date. It was apparent at the claim construction hearing that whether ozone is a radical is an issue in this case, and that ozone may have properties that may make it difficult to categorize as a radical or an ion in this context. As ASM notes, the issue may be unimportant, as the ordinary byproduct of a plasma discharge includes both radicals and ions. For now, the Court construes radical as "highly reactive gas fragments that typically possess at least one unpaired valence electron (including certain atoms or molecules produced as a result of a glow discharge) that allow or encourage the desired

reaction."

C. The'568 patent

The '568 patent is entitled "Method of Selective Etching Native Oxide." All of the disputed terms appear in claim 8, which claims:

> The method for processing semiconductor wafers comprising the steps of:
>
> positioning a substrate in a treatment chamber;
>
> controlling the temperature of the substrate;
>
> exposing the substrate to a mixture of hydrogen halide vapor and either water vapor or a vapor of a hydroxyl-containing replacement for water vapor to etch native oxides from a surface of the substrate; and
>
> controlling the partial pressure of at least one of the vapors to delay condensation of water vapor on the other oxides while native oxides are being etched.

('568 patent 8:15-26.)

In semiconductor device processing, undesirable native oxides form on freshly etched silicon due to exposure to air, water or the etching chemicals themselves. (Id. 1:12-14.) The invention of the '568 patent is "a method for selectively etching native oxides by exposing a substrate in a treatment chamber to hydrogen halide vapor and water vapor under appropriate conditions and long enough to remove the native oxide but not long enough to remove any significant amount of other oxides." (Id. 2:49-54.)

The parties dispute the construction of the following terms from the claims of the '568 patent.

Disputed Claim Language	ASM's construction	Genus's construction

controlling the temperature of the substrate	directly measuring and maintaining the temperature of the substrate by an apparatus for heating semiconductor substrates	no construction necessary

On its face, the meaning of "controlling the temperature of the substrate" is clear. There must be a method of changing and maintaining the temperature of the substrate. ASM argues, however, that the specification clearly indicates that the substrate must be heated in a particular way.

ASM points to the following language from the specification, which is the only portion of the specification that discusses the desired temperature of the substrate:

> Since native oxide can be etched with HF/H_2O vapor and HF/HCl/H_2O vapor before condensation of the vapor on the thermal oxide surface, condensation of the vapor on the thermal oxide is preferably controlled to increase the time available to etch the native oxide before initiation of thermal oxide etch. Temperatures and pressures are controlled to defer initiation of condensation. It has been discovered that in the HF/H_2O vapor process of the present invention, the liquid HF/H_2O does not condense if the wafer temperature is above about 27˚-28˚C. Accordingly, applicants' process includes provision for heating the wafer above about 27˚-28˚ C. such as up to 30˚C. via the semiconductor substrate heater described in U.S. Pat. No. 4,778,559 or with infrared or ultraviolet energy. Alternatively, the water vapor partial pressure in the reactor can be reduced to delay condensation of water vapor on the thermal oxide.

('568 patent 7:21-38.) This language appears in the section of the specification entitled "Description of the Preferred Embodiment," however. Nothing in the specification or the prosecution history <u>requires</u> the substrate to be heated in any particular way. As Genus points out, it is black letter patent law that "limitations from elsewhere in the specification will not be read in where, as here, the claim terms are clear." <u>Tate Access Floors</u>, 279 F.3d at 1371. "References to a preferred embodiment, such as those often present in a specification, are not claim limitations." <u>Laitram Corp. v. Cambridge Wire Cloth Co.</u>, 863 F.2d 855, 865 (Fed. Cir. 1988). "In the course of construing the disputed claim terms, a court should not ordinarily rely on the preferred embodiments <u>alone</u> as representing the entire scope of the claimed invention." <u>CCS</u>, 288 F.3d at 1370 (emphasis added). The language ASM cites to is not a definition of the term "controlling," but simply provides examples of several ways to control the temperature of the substrate.

Accordingly, the Court adopts the plain meaning of the claim language and finds that no construction is necessary.

Disputed Claim Language	ASM's construction	Genus's construction
exposing the substrate to a mixture of hydrogen halide vapor and either water vapor or a vapor of a hydroxyl-containing replacement for water vapor to etch native oxides from a surface of the substrate	mixing a precursor consisting of hydrogen halide vapor and a precursor consisting of either water vapor or ethyl alcohol, methyl alcohol or isopropryl alcohol and passing the combined vapors through the reaction chamber to the substrate	"vapor of a hydroxyl-containing replacement for water vapor" is the gas phase of a compound, other than water, containing a hydroxyl (OH) group

Here, the parties agree that hydrogen halide vapor is "the gas phase of a compound consisting of a hydrogen atom and a halogen atom (i.e., HF, HCl, HI, HBr, or HAt)." They disagree about the meaning of a "hydroxyl-containing replacement for water vapor," and whether the mixture of the vapors must occur prior to entering the reaction chamber. The parties also disagreed initially about whether the water vapor used in the process must be introduced from outside the chamber or whether the process can use only the water vapor that is produced in the chamber as a result of the reaction. Genus concedes in its reply brief, however, that some water vapor must be introduced from outside the chamber.

"Mixture"

Nothing in the claim language itself requires the mixture of "hydrogen halide vapor and either water vapor or a vapor of a hydroxyl-containing replacement for water vapor" to occur outside the reaction chamber. The claim language simply requires that the substrate be exposed to such a mixture, which could, under the plain meaning of the claim language, occur by adding the substances separately to the reaction chamber so that they mix in the reaction chamber itself.

ASM's expert, Martin L. Hammond, states in his expert report, however, that the person of ordinary skill in the art would understand that the vapors are mixed together outside the reaction chamber, and then the mixture is subsequently passed through the reaction chamber to the substrate. (Brown Decl., Ex. F, Hammond expert report 6:3-8, 7:7-9.) Genus' expert, Oldham, correctly points out that Hammond relies on language describing preferred embodiments, which are not limitations on the claim language. (Brown Decl., Ex. E, Oldham Rebuttal Expert Report at 8.)

For example, the specification states that "[i]n accordance with a principal embodiment of the present invention, the hydrogen halide is either hydrogen fluoride or hydrogen fluoride and hydrogen chloride each derived from a separate aqueous solution or derived from a common aqueous solution[.]" (Id. 2:55-59.) In another description of a preferred embodiment, "a hydrogen halide vapor such as HF vapor and water vapor or HF vapor, HCl vapor and water vapor in an inert carrier gas such as nitrogen is passed through the reactor chamber for exposing the oxides on the substrate[.]" (Id. 4:6-9.) Figure 2, which describes a preferred embodiment, also shows the vapors being mixed outside the chamber. (Id., Fig. 2, and 5:13-44.) The specification also contains other language describing preferred embodiments in which the vapors are mixed before being introduced into the reaction chamber, as Hammond cites in his expert report. Nothing in the specification, however, even suggests that the mixture must occur outside the reaction chamber. "In the course of construing the disputed claim terms, a court should not

ordinarily rely on the preferred embodiments alone as representing the entire scope of the claimed invention." CCS, 288 F.3d at 1370.

It is also true that claims 2 through 7, and 9 through 17, each claim a method using various hydrogen halides in water. (Id. 7:65-8:14, 8:27-46.) Dependent claims, by definition, though, place no limitations on the independent claim upon which they depend. 35 U.S.C. § 112 ¶ 4 ("a claim in dependent form shall contain a reference to a claim previously set forth and then specify a further limitation of the subject matter claimed.") It is black letter law that each claim sets forth a distinct and separately patentable invention. 35 U.S.C. § 112 ¶ 2. Thus, the fact that a limitation exists in one claim does not require that the same limitation appear in any other claim.

It is undisputed that HF vapor reacts with silicon dioxide wafers to create water as a by-product. The parties originally disputed whether the process claimed by the '568 patent could use that water by-product as the only water vapor in the reaction, or whether the claims required that the water vapor be introduced from outside the chamber. Genus concedes in its reply brief, however, that "during prosecution the '568 applicants limited the claim language 'exposing the substrate to hydrogen halide vapor and water vapor' so as to exclude water that was generated as a byproduct of the etching reaction." (Reply brief at 15; see also Brown Decl., Ex. H (Prosecution History) at '568 FH0066-67.)

The Court rejects Genus' claim that only claim 1 excludes water that was generated as a byproduct of the etching reaction, however. Genus contends that claim 8 is not so limited because it does not require water vapor at all. The relevant language of claim 1 requires "exposing the substrate to a mixture of hydrogen halide vapor and water vapor to etch native oxide," while the relevant language of claim 8 requires "exposing the substrate to a mixture of hydrogen halide vapor and either water vapor or a vapor of a hydroxyl-containing replacement for water vapor to etch native oxides[.]" Although claim 8 does not require the use of water vapor, it does provide for the use of water vapor as one alternative. The Court does not see how claim 8 can be construed to permit the use of water vapor that is created as a byproduct of the reaction just because the claim also permits the use of a substitute for water vapor. Claim 8 claims the use of water vapor, just as does Claim 1. To the extent the process of Claim 8 uses water vapor, it is subject to precisely the same limitations as claim 1.

Accordingly, the Court finds that the "mixture" contemplated by the claim language need not

occur outside the reaction chamber. Each of the ingredients of the mixture, i.e., the "hydrogen halide vapor and either water vapor or a vapor of a hydroxyl-containing replacement for water vapor," must come from outside the reaction chamber, however. In particular, water vapor must be introduced to the reaction chamber from outside the chamber, and cannot exist in the chamber solely as a by-product of reactions occurring inside the chamber.

"Hydroxyl-containing replacement for water vapor"

ASM contends that "hydroxyl-containing replacement for water vapor" is limited to ethyl alcohol, methyl alcohol or isopropryl alcohol. Genus argues that the phrase is not limited to those three substances.

The specification is ambiguous. The relevant language from the specification provides:

> While the invention has been described above with reference to HF vapor and water vapor or HF vapor, HCl vapor and water vapor as the vapor etchant, other hydroxyl-containing substances could serve as a replacement for the water. Appropriate hydroxyl-containing replacements are ethyl alcohol, methyl alcohol and isopropyl alcohol.

(Id. 7:14-20.) The parties dispute whether the last sentence is a limitation or whether it merely sets forth three examples. ASM contends that it means "The only appropriate hydroxyl-containing replacements are ethyl alcohol, methyl alcohol and isopropyl alcohol," while Genus contends that it means "Appropriate hydroxyl-containing replacements include, but are not limited to, ethyl alcohol, methyl alcohol and isopropyl alcohol." The meaning of the sentence is ambiguous on its face.

The parties agree that a "hydroxyl-containing" substance is one that contains an OH group (an oxygen atom bonded to a hydrogen atom). The parties dispute, however, whether any substance with an OH group can be considered to be a "replacement for water vapor." ASM argues that there are thousands of substances that contain a hydroxyl group, and that it would be inappropriate to include all of them in the definition. (Brown Decl., Ex. I, Hammond Rebuttal Report at 4.) ASM does not attempt to explain why any of these other hydroxyl-containing substances would not be an adequate replacement for water vapor in the context of the invention, however, other than to point out, in the abstract, some differences between water and other hydroxyl-containing substances.

Genus points out that the "summary of the invention" portion of the specification states that "other hydroxyl containing substances can serve as replacements for the water" ('568 patent 3:13-14),

without limiting those substances to the three types (ethyl alcohol, methyl alcohol and isopropyl alcohol) that appear later in the patent. Genus' expert, William G. Oldham, explains that the purpose of water in the context of the invention is to serve as a solvent to ionize the hydrogen halide so that the etching reaction can proceed. (Brown Decl., Ex. E, Oldham Rebuttal Report at 15.) Thus, the water serves as a catalyst to initiate the etching process. (Id.) Oldham states that ethyl alcohol, methyl alcohol and isopropyl alcohol also act in the same fashion, as does acetic acid, a hydroxyl-containing substance that is not mentioned in the specification. (Id. at 16.)

Hammond does not dispute Oldham's conclusion that acetic acid also acts as a solvent that can serve as a catalyst to initiate the etching process. Hammond does set forth some ways in which acetic acid is different from ethyl alcohol, methyl alcohol and isopropyl alcohol, but he does not argue that acetic acid cannot serve the same function as those substances in the context of the process used in the invention. Instead, Hammond points out that a later-issued patent exists for the use of HF vapor and glacial acetic acid vapor to etch silicon oxide, and thus Hammond essentially concedes that acetic acid can be used in the process. (Brown Decl., Ex. F, Hammond Expert Report at 16.) It is clear from Oldham's rebuttal expert report, however, that while the pK_a (which uses a logarithmic scale) of water, methyl alcohol, ethyl alcohol, and isopropyl alcohol all hover around 16, the pK_a of acetic acid is approximately 5, and thus would appear to be much less effective as a solvent that ionizes the hydrogen halide so that the etching reaction can proceed. (Oldham Rebuttal Expert Report at 16 n.31 and n.32.) The Court therefore declines to find, at this time, based on the current record, that acetic acid serves as an adequate substitute for water vapor.

Nonetheless, the Court agrees with Genus that "hydroxyl-containing replacement for water vapor" is not limited to ethyl alcohol, methyl alcohol or isopropyl alcohol, but includes other substances containing an OH group which serve as a solvent to ionize the hydrogen halide so that the etching reaction can proceed.

/ /

/ /

/ /

/ /

Disputed Claim Language	ASM's construction	Genus's construction
controlling the partial pressure of at least one of the vapors to delay condensation of water vapor on the other oxides while native oxides are being etched.	to control the pressure of particular gas in a mixture of gases through the use of a feed-back loop so that initially no liquid film of water forms on non-native oxide surfaces, and in a later stage of the process, a liquid film of water does form on the non-native oxide surface, timed so that the time period in which only native oxides are being etched ends at the moment that a liquid film of water forms on the non-native oxide surface	"condensation" means "the formation of liquid from vapor"; otherwise, no construction necessary

"Controlling the partial pressure of at least one of the vapors"

Although neither the language of the claim nor the specification of the patent sets forth any particular method for controlling the partial pressure, ASM argues that the pressure must be controlled through use of a feed-back loop. ASM's expert, Martin Hammond, states that the specification shows the maintenance of a constant pressure in the reaction chamber by various feedback loop mechanisms. (Brown Decl., Ex. F (Hammond Expert Report) at 9.) Hammond points to the presence of mass flow controllers at several points in the specification. (See, e.g., '568 patent 5:19-27.) According to Hammond, one of ordinary skill in the art knows that mass flow controllers would be required to achieve the necessary precision, and that they use measurement and feedback control. (Hammond Expert Report at 9-10.) Hammond also points to the specific sub-atmospheric pressure of 350 Torr cited at column 5, lines 53 and 63, and the fact that the native oxide is etched within ten to twelve seconds ('568 patent 5:59-61, 6:68, 7:13). Hammond contends that one of ordinary skill in the art would recognize that such a result would require active pressure measurement and control using feedback mechanisms. (Hammond

Expert Report at 10.) Hammond also argues that the specific temperature control of vaporizers set forth at column 6, lines 10-39, and the controls specified therein for the total pressure and flow rate of the inert gas through each temperature-controlled vaporizer inherently require measurement and feedback mechanisms to achieve repeatable results under dynamic conditions. (Hammond Expert Report at 10.)

All of Hammond's examples, however, are from the description of a preferred embodiment,

which does not limit the language of the claims. Genus' expert, William Oldham, notes that the summary of the invention does not set forth any method of controlling the pressure but simply states that "[t]he temperature of the substrate and/or vapor and/or the pressure of the vapor are controlled to prevent vapor from condensing on the substrate until the native oxide is removed." ('568 patent 3:8-11.) Oldham states in his rebuttal expert report that "[m]echanisms for 'controlling' the partial pressure are not discussed in the '568 patent, because one of ordinary skill in the art would have known that there are multiple mechanisms by which such control can be obtained and that the appropriate mechanisms would depend on the design of a particular reactor and a particular process." (Brown Decl., Ex. E (Oldham Rebuttal Report at 9-10.) Oldham states that one such method for adjusting the pressure is simply to adjust the flow rate. (Id. at 10.)

As the summary of the invention and the plain language of the claim support Genus' contention that the '568 patent does not require any particular method of controlling the partial pressure, the Court rejects ASM's construction, and finds that "controlling the partial pressure" needs no construction.

"Condensation of water vapor on the other oxides"

The parties dispute whether "condensation" requires the formation of a "liquid film of water" on the non-native oxides, or whether it only requires the formation of liquid. Genus' expert, Oldham, states that in the context of the claim, "condensation" means the formation of a liquid from vapor. (Brown Decl., Ex. E, Oldham Expert Report at 10.) Under some conditions, that condensation can coalesce into a film. (Id.) Condensation can also form as droplets. (Id. at 11.)

ASM's expert, Hammond, concedes in his rebuttal report that Oldham's statement is correct. (Brown Decl., Ex. I, Hammond Rebuttal Report at 2.) Nonetheless, he states that ASM's construction is more accurate in the context of the patent, because the patent addresses condensation on silicon oxide surfaces. (Id. at 2.) "Because silicon oxide is a hydrophilic surface, any condensation of water vapor onto its surface may initially take the form of tiny droplets; however, these will soon coalesce and form a film of water." (Id.) As Hammond concedes that condensation may initially take the form of tiny droplets, the Court rejects ASM's construction of "condensation," which requires the formation of a liquid film. Nothing in the patent even suggests that a liquid film must form. At the claim construction hearing, however, the parties agreed that any condensation of droplets of water on a hydrophilic surface

such as a silicon oxide wafer will quickly coalesce and form a film of water.

ASM also argues in its brief that defining "condensation" as a "film" is necessary to avoid confusing laypersons (presumably, the jury) into thinking that molecules of water that adsorb on a surface during a phenomenon known as "enhanced adsorption" might fall within the definition of "liquid." This argument is not addressed in the expert reports, however, and there is no other information about "enhanced adsorption" provided in the parties' briefing. As there is no evidentiary basis for this argument, the Court disregards it.

ASM also asserts an entirely new argument, not contained in the parties' joint claim construction statement, that condensation should be defined "as the formation of a liquid film from the vapor phase, as described in the phase diagram of Figure 13." This argument also does not appear in the parties' expert reports, other than as a single line in the Hammond report. Genus complains that the argument was not raised until a few days before the opening brief was due, and was not the subject of expert discovery. Figure 13 is "a graph of H_2O partial pressure plotted against HF partial pressure to show the H_2O and HF partial pressure ranges for H_2O condensation for various temperatures." ('568 patent 3:52-55.) As already noted, however, nothing in the specification requires the formation of a liquid film. Moreover, if ASM is concerned about confusing laypersons, using Figure 13 as a definition of condensation will surely not help avoid juror confusion. It also appears that there is some doubt that the graph that appears in Figure 13 is entirely accurate, as inventor Bruce Deal testified at deposition that there are some discrepancies between when Figure 13 would predict condensation to occur and when a similar figure in a published scientific article that he co-wrote would predict condensation to occur. (Brown Supp. Decl., Ex. D, Deal Dep. 110:18-112:25; id. Ex. F.) Most importantly, nothing in the specification even suggests that the inventors are attempting to define the meaning of condensation by

reference to Figure 13. Instead, Figure 13 shows how changes in partial pressure affect condensation

at various temperatures. The Court declines ASM's invitation to use Figure 13 as part of the definition of condensation.

Accordingly, the Court construes "condensation" in accordance with its ordinary meaning of "the formation of liquid from vapor." On silicon oxide wafers, condensation begins with tiny droplets that soon form a film of water.

"Delay condensation of water vapor on the other oxides while native oxides are being etched"

Here, the dispute is whether the condensation is merely postponed, but ultimately does occur during the process of etching the native oxides, or whether "delay condensation" can also mean "avoid or prevent condensation" during the process of etching the native oxides. ASM argues that this language should be construed as "initially no liquid film of water forms on non-native oxide surfaces, and in a later stage of the process, a liquid film of water does form on the non-native oxide surface, timed so that the time period in which only native oxides are being etched ends at the moment that a liquid film of water forms on the non-native oxide surface." Genus argues that there is no requirement that condensation occur during the process.

The '568 patent explains that:

> While we do not wish to be bound by any particular theory of operation, we believe that native oxide etching is initiated and performed by HF/H_2O in vapor phase, perhaps in conjunction with a different chemical make up and/or with H_2O adsorbed in the native oxide, whereas the thermal oxide etching is typically not initiated until vapor condenses on the thermal oxide surface. The time offset after native oxide etching begins and before the thermal oxide begins to be etched permits the removal of the native oxide. Other deposited oxides operate similar to the thermal oxide although some begin etching more quickly than the thermal oxides.

('568 patent 4:39-50.) Thus, according to the theory of the invention, as long as the vapors do not condense on the thermal oxide surface, only native oxides will be etched.

The summary of the invention provides:

> In accordance with another aspect of the present invention, the substrate is exposed to the hydrogen halide vapor and water vapor until vapor begins to condense on the substrate.
>
> In accordance with still another aspect of the present invention, the treating conditions are maintained to prevent water vapor from condensing on the substrate until sufficient native oxide is etched so that substantially all of the native oxide will be etched before appreciable other oxides are etched. The temperature of the substrate and/or vapor and/or the pressure of the vapor are controlled to prevent vapor from condensing on the substrate until the native oxide is removed.

('568 patent 2:67-3:11.) Both of these aspects of the invention contemplate that condensation eventually will occur during the process of etching the native oxide. In addition, the abstract of the invention provides: "Treating conditions are maintained to prevent water vapor from condensing on the substrate until sufficient native oxide is etched so that substantially all the native oxide will be etched before appreciable other oxides are etched." By stating that condensation will be prevented until substantially all the native oxide will be etched, the abstract contemplates that condensation will occur before all of the native oxide has been etched. Figure 1D also shows the thermal oxide starting to etch before the native oxide is completely etched, and thus, under the theory of the invention, shows that condensation has begun before the native oxide is completely etched.

In one of the preferred embodiments, however, the inventors contemplate a process in which condensation will not occur at all:

> It has been discovered that in the HF/H_2O vapor process of the present invention, the liquid HF/H_2O does not condense if the wafer temperature is above about 27˚-28˚C. Accordingly, applicants' process includes provision for heating the wafer above about 27˚-28˚C. such as up to 30˚C. via the semiconductor substrate heater described in U.S. Pat. No. 4,778,559 or with infrared or ultraviolet energy.

('568 patent 7:28-35.) According to this language, if the wafer is heated above 27˚-28˚C throughout the entire process, condensation will never occur. As the patent specification discloses a method in which condensation will never occur during etching of the native oxide, the Court almost certainly must construe the phrase "delay condensation" to mean "postpone or prevent condensation." "[A] claim construction that excludes a preferred embodiment is rarely, if ever, correct." Dow Chemical Co., Ltd. v. Sumitomo Chemical Co. Ltd., 257 F.3d 1364, 1378 (Fed. Cir. 2001) (citing Vitronics, 90 F.3d at 1583). "This is because 'it is unlikely that an inventor would define the invention in a way that excluded the preferred embodiment, or that persons of skill in this field would read the specification in such a way.'" Id. (citing Hoechst Celanese, 78 F.3d at 1581).

The prosecution history also supports this construction. As Genus notes, the claim language about delaying condensation was added to the claims in the final amendment that was submitted to the patent office before the claims were allowed. (Brown Decl., Ex. H (prosecution history) at 112 (Dec. 17, 1992 amendment) and 118 (Notice of Allowance dated March 3, 1993). Those amendments were intended, in part, to distinguish a prior patent issued to Faith Jr. The applicants explained that the diagram in Figure 13 of the '568 patent "discloses, as is not taught by Faith Jr., that there are many combinations of partial pressure of constituents of the vapor mixture at specific temperatures which will result in no apparent condensate on the substrate surface." (Id. at 116 (emphasis added).) The applicants also noted that "There is no suggestion in Faith Jr. to control the partial pressures as a mechanism for delaying or preventing condensation." (Id.) This is the only discussion in the prosecution history about delaying condensation, and this language supports Genus' contention that the claim language was intended to include processes in which no condensation occurred during the etching of native oxide.

As Oldham notes in his rebuttal expert report, a requirement that condensation occur at some point during the process "is wholly inconsistent with the purpose of the invention described and claimed in the '568 patent." (Brown Decl., Ex. E, Oldham Rebuttal Expert Report at 2.)

> One of ordinary skill in the art would understand that the '568 patent is directed at a method for selectively etching of native oxides, which means as Dr. Hammond explains, "removing native oxide without removing any significant amount of other oxides." The '568 patent teaches a particular method of selectively etching native oxides which exploits the fact that etching of the "other oxides," is "typically not initiated until vapor condenses on the [other] oxide surface," while etching of native oxides can occur "before condensation of vapor on the [other] oxide surface." . . . One of ordinary skill in the art would have recognized that the method described in the '568 patent generally seeks to avoid condensation of water vapor on the other oxides while the native oxides are being etched in order to achieve "selective" etching of the native oxides. . . .
>
> In sum, one of ordinary skill in the art would understand that the goal of the method described in the '568 patent is avoiding condensation on the other oxides to the extent practical. This is wholly inconsistent with Dr. Hammond's opinion that the claim somehow requires ensuring that condensation occur on the other oxides at some point "within the frame of the process."

(Id. at 2-3 (citing inter alia, '568 patent 4:40-45, 7:21-26).)

ASM argues, however, that during the prosecution of the '568 patent the inventors disclaimed a process in which condensation does not occur during the process of etching the native oxide. ASM points to page 67 of the prosecution history, where the inventors attempted to distinguish the Miki prior art from their invention:

> In the Miki reference it is not a matter of etching native oxide before etching thermal oxide with a particular vapor. Rather, Miki maintains that only native oxide (and not thermal oxide) will be etched by an HF and nitrogen gas as long as the HF concentration is in the range of 0.6 to 4.7 percent.

(Brown Decl., Ex. H. (Prosecution History) at 67.) ASM misinterprets this statement as explicitly disclaiming processes that did not etch thermal oxide at all, i.e., processes in which condensation on thermal oxide is avoided. First, nothing in either Miki or this part of the '568 prosecution history even mentions condensation. Indeed, at the time these statements were made to the patent examiner, the "delay condensation" language had not yet been added to the claim language of the '568 patent. For this reason alone, these statements in the prosecution history cannot limit the "delay condensation" language that was later added to the '568 patent.

Second, Miki did not realize that by postponing or avoiding condensation, it was possible to etch only the native oxides. Instead, Miki was directed at using low concentrations of HF to etch native oxides without etching thermal oxides, as the '568 inventors pointed out. (Id.) To be sure, the inventors' statements do suggest that the inventors contemplated that the invention of the '568 patent used only processes, unlike Miki, that could result, if they were permitted to run long enough, in etching of the thermal oxide. Nothing in this discussion, however, requires that the processes always run long enough to etch thermal oxide, or that condensation must occur before the process stops. Moreover, as already noted, the patent specification specifically contains language identifying a process in which condensation will never occur during the process of etching the native oxide. The Court rejects ASM's contention that, in distinguishing the Miki reference, the '568 inventors disclaimed a process in which condensation never occurs.

The Court also rejects ASM's suggestion that claim 8 would necessarily be invalid in light of Miki if the Court were to construe "delay condensation" to include processes in which condensation never occurs. Even if Miki and the claim 8 process both describe processes in which condensation never occurs, there are still a significant difference between Miki and the '568 patent. Unlike the '568 patent, Miki does not teach the use of a mixture of hydrogen halide vapor and water vapor to etch native oxide, but teaches away from it.

ASM cites Bruce Deal's deposition testimony as further evidence that condensation must occur during the etching process for the process to be covered by the '568 patent. Deal was one of the inventors of the process patented in the '568 patent. Deal's testimony is inconclusive. For example, Deal's answers to a series of questions suggested that the invention covered processes in which condensation did not occur on the thermal oxide before the native oxides were completely etched:

> Q: You'd select the parameters that allowed for a sufficient delay period – that in between the time when the native oxide starts to etch and when condensation actually occurs on the thermal oxide, correct?
>
> A: Yeah, but you keep bringing in condensation. Even though condensation is occurring, that's not what you select. You select etch conditions, characteristics, for the thermal oxide that you might or might not want later, but you want to have sufficient time before that starts to occur to etch the native oxide that might be present.

(Brown Supp. Decl., Ex. D (Deal Dep.) 121:4-23.)

> Q: What if you set the process parameters in terms of the partial pressures so that the thermal oxide never etched; would that be the type of method that's taught by the '568 patent, in your view?
>
> A: It certainly would fall under the patent. There's nothing in the patent, I believe, that says you have to go ahead and etch the thermal oxide.

(Id. 133:14-20.)

> Q: And you're saying that you interpret your patent, which says that you're – to delay condensation while native oxide is being etched so that it includes a situation where you never etch the thermal oxide; did I understand you correctly?
>
> A: Well, you can include that. Is there anything in the patent that says you can't?

(Id. 139:18-24.) Later, though, Deal's testimony changed somewhat:

> Q:. . . You set your process parameter so that no matter how long you run it, your pressures and temperatures and partial pressures are such that you will not have condensation on the thermal oxides. Is that the kind of method that you intended to teach by the '568 patent?
>
> A: I don't think we considered that.
>
> Q: So the answer is, no, it is not the type of method that you intended to teach?
>
> A: No.

(Id. 148:17-149:1.) Then Deal narrowed this testimony:

> Q: So it is – the type of method that you were intended was one where the process parameters were set up so that if they continued, at least at some point, you would etch the thermal oxide, correct?
>
> A: That's probably correct, right.

(Id. 150:3-7.) Thus, by the end of his deposition, Deal had testified that his patent covered a process in which parameters were set so that condensation could occur, but that the process did not need to run until condensation actually did occur. The one thing that is clear from Deal's testimony is that the precise issue that is currently being debated by the parties was not an issue to which he had given a great deal of thought. Especially in light of the lack of clear evidence of intent,"[t]he subjective intent of the inventor when he used a particular term is of little or no probative weight in determining the scope of

a claim (except as documented in the prosecution history)." Markman, 52 F.3d at 979. Cf. Voice Technologies, 164 F.3d at 615 (inventor is competent to explain the invention and what was intended to be covered by the claims, but cannot change the invention and the claims from their meaning at the time the patent was drafted and granted).

The specification and the prosecution history both suggest that the ’568 patent is not limited to processes in which condensation ultimately occurs during the process of etching the native oxide. Accordingly, the Court construes “delay condensation” to mean “postpone, prevent, or avoid condensation.”

III. CONCLUSION

For the reasons set forth above, and for good cause shown, the Court construes the disputed terms of the ’590, ’365, and ’568 patents as follows:

1. The ’590 patent:

Disputed claim language	Court’s construction
Evacuate	Evacuation is accomplished by using a vacuum pump to suck the reactant gases out of the reaction space. Evacuation does not encompass using an inert gas to push the reactant gases out of the reaction space. Because the process of the ’590 patent always operates in a chamber that is maintained by a vacuum pump at below-atmospheric pressure, evacuation requires that the vacuum pump operate at a higher intensity during the evacuation step. There is no requirement that the pressure drop in the reaction space during evacuation, because the claims of the ’590 patent require simultaneously feeding in an inert gas to push the reactant gases out of the reaction space. Whether there is a net pressure drop in the reaction space during evacuation depends on the partial pressure of the reactant gases being vacuumed out of the space compared to the partial pressure of the inert gas being simultaneously injected into the reaction space.
Reaction space	The reaction space includes the reaction chamber as well as the gas inflow/outflow channels communicating immediately with the reaction chamber, and includes the entire volume to be evacuated between two successive vapor-phase pulses.
Substantially all of said reactants remaining in said reaction space and adsorbed on inner walls of said reaction space are removed to a level of less than 1% prior to the inflow of a second pulse	More than 99% of the combined total amount of the unreacted reactants remaining in the reaction space and those adsorbed on the inner walls of the reaction space are removed before the inflow of a second pulse.

2. The ’365 patent:

Disputed claim language	Court's construction
A sequential chemical vapor deposition process	The process commonly referred to as Atomic Layer Deposition. For the first cycle in the process, the steps of claims 1 and 16 (and necessarily in all the dependent claims) must be performed in order. The second and all subsequent cycles start with the step that begins with "exposing the part to a gaseous first reactant."
Evacuating the chamber of gases	Removing gases from the chamber with a vacuum pump. The term does not encompass the use of an inert gas to push gases out of the reaction chamber.
Exposing the part to a gaseous first reactant, including a non-semiconductor element of the thin film to be formed, wherein the first reactant adsorbs on the part	Exposing the part to a gaseous first reactant, including an element that is not a semiconductor and that will be contained in the thin film to be formed, wherein the first reactant adsorbs on the part. The thin film that is formed may be a conductor, non-conductor, or semiconductor. The claim contains no limitation on the conductivity of the thin film that is to be formed.
A second reactant gas of radicals	A second reactant gas that includes radical atoms or molecules, which are highly reactive gas fragments that typically possess at least one unpaired valence electron (including certain atoms or molecules produced as a result of a glow discharge) that allow or encourage the desired reaction.

3. The '568 patent:

Disputed claim language	Court's construction
controlling the temperature of the substrate	No construction necessary

exposing the substrate to a mixture of hydrogen halide vapor and either water vapor or a vapor of a hydroxyl-containing replacement for water vapor to etch native oxides from a surface of the substrate	Hydrogen halide vapor is the gas phase of a compound consisting of a hydrogen atom and a halogen atom (i.e., HF, HCl, HI, HBr, or HAt). "Hydroxyl" refers to a group of atoms made up of a hydrogen atom bonded to an oxygen atom, which is also referred to as an OH group. A hydroxyl-containing replacement for water vapor is not limited to ethyl alcohol, methyl alcohol or isoproprуl alcohol, but includes any substance containing an OH group which plays the same role as water vapor in the etching process, that is, to serve as an effective solvent to ionize the hydrogen halide so that the etching reaction can proceed. The mixture of hydrogen halide vapor and either water vapor or a vapor of a hydroxyl-containing replacement for water vapor can occur inside or outside the reaction chamber. Each of the ingredients of the mixture, i.e., the "hydrogen halide vapor and either water vapor or a vapor of a hydroxyl-containing replacement for water vapor," must originate outside the reaction chamber, however. In particular, water vapor must be introduced to the reaction chamber from outside the chamber, and cannot exist in the chamber solely as a by-product of reactions occurring inside the chamber.
controlling the partial pressure of at least one of the vapors to delay condensation of water vapor on the other oxides while native oxides are being etched.	No construction is necessary of "controlling the partial pressure of at least one of the vapors." Condensation is the formation of liquid from a vapor. On silicon oxide wafers, condensation begins with tiny droplets that soon form a film of water. Condensation of water vapor on the non-native oxides is postponed, avoided, or prevented while native oxides are being etched.

IT IS SO ORDERED.

Date: August 15, 2002

ELIZABETH D. LAPORTE
United States Magistrate Judge

Copies mailed to
counsel of record